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ABSTRACT

Successful collaborative efforts depend upon an efficient workgroup communication network. With the continuing evolution of powerful information and communication technologies, designers are facing the challenge of fitting these technologies to organizational and workgroup structures and workstyles. The goals of this project are to use previous research on workgroups in selected occupations and apply it to teachers at two middle schools in order to learn about their collaboration and the ways technologies can be designed to support them. The changing roles of teachers have direct implications for product development and marketing strategies in four areas. First, overburdened by large class sizes and the expanding social needs of their students, teachers have a need to share and coordinate ideas and information which new and existing technologies can address. Second, the social needs of students overflow into every aspect of the teacher's workday. A combination of new and existing communication and information technologies could help teachers to contact parents and social service providers. Third, education, social conditions, and political attitudes are converging. Technology will aid in coordinating this blend of needs resulting from the complex communicative problems involved. Finally, integrating education with other social services will focus on the child in market and product strategies, which may be particularly successful in the new educational environment. (90 references) (64 tables) (LAP)

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THE Northwest Regional Educational Laboratory

PROGRAM REPORT

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TEACHER COLLABORATION AND CONSTRAINT: QUANTITATIVE ETHNOGRAPHIES OF TWO MIDDLE SCHOOLS

Final Report

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Final Report

June 1991

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EXECUTIVE SUMMARY

The efficient and effective transfer of information among members of workgroups is a key to successful collaborative efforts. With the continuing evolution of powerful information and communication technologies, designers are facing the challenge of fitting these technologies to organizational and workgroup structures and workstyles. The ability of designers to develop and deploy new technologies requires an understanding of the interaction of systems and organizations. Thorough research in the interplay among workgroups' structures, styles, collaboration processes, communications and channel choices is necessary for the design of communication support systems.

Project Goals

The goals of the project, Teacher Collaboration and Constraint: Quantitative Ethnographies of Two Middle Schools, are to extend and apply our previous research on workgroups in selected occupations to teachers in order to learn about their collaboration and the ways technologies can be designed to support them.

Key Findings and Implications

The study suggests critical new roles for communication technologies in supporting K-12 schools and teachers. Findings from this study highlight the changing roles of teachers, their economy of time and communication, and the need to support both internal and external systems for their communication. These findings have direct implications for product development and marketing strategies in several areas:

- **Support regular classroom teachers and teachers in special roles.** Overburdened by large class sizes and the expanding social needs of their students, teachers often are unable to collaborate and communicate effectively or efficiently. New and existing technologies need to address the increasing needs of teachers to share and coordinate ideas and information.

- **Support parent-teacher and teacher-social service provider communications.** As the social needs of students continue to overflow into every aspect of the teacher's workday, teachers are finding it increasingly difficult to contact parents and social service providers--essential participants in the effort to meet individual students' needs. A combination of new and existing communication and information technologies could help meet these needs.

- **Design and market with attention to the changing political and economic context of education.** Currents in education, social conditions and political attitudes are converging, creating a stream of challenges and unprecedented opportunities. Successfully coordinating this blend of needs and visions will require technological solutions to the complex communicative problems involved.

- **Adopt a market strategy emphasizing the child as beneficiary.** The movement to integrate education with other social services will heighten the visibility of the child as the focal point of these institutional networks. Market and product strategies which similarly center around the child may be particularly successful in this new environment.

Results

Focusing on workgroup tasks, communicative interactions and technology, this study provides qualitative and quantitative data which depict the fine-grained, dynamic structure of the collaborative non-instructional activities of teacher workgroups. Methods and measures are described for tracking multiple ongoing tasks of individuals and workgroups. Teachers face tensions between the time and communicative resources they need to complete their tasks as instructors (Job 1) and social workers (Job 2). Though teachers often strive to collaborate with their peers, severe constraints are placed on these efforts by the nature of time and space in the classroom and school building. Indeed, these constraints are found to be deeply embedded and play a key role in shaping opportunity and success for collaboration among teachers. The dimensions of temporal and spatial organization and their impact on communication channel choice are examined and discussed. An analysis of contrasting workgroup communication patterns and channel choice behaviors is presented for the studied groups.

Suggested Lines of Further Inquiry

- Examine models of ways the two jobs of teaching can be better coordinated and undertake further R & D on the potential role of communication and information technology in restructuring education and family-oriented social services.

- Conduct and carefully evaluate a trial of voice mail and voice-based information technologies in a school setting, focusing on the impact of the innovation on all users--parents, teachers, administrators and social service agencies.

- Synthesize research findings pertaining to workgroup communication derived from this and earlier related studies of marketing (funded by Advanced Technologies) and manufacturing workgroups.

- Undertake a more detailed analysis of electronic mail collected in this and earlier related studies. This analysis would further illuminate needs for and capabilities of this technology in schools and other occupational settings based on data reflecting actual workgroup usage.

The Field Setting

The study was conducted among teachers in two middle schools. Both schools had established collaboration among teachers as goals. In the first, teacher teams called "neighborhoods" had been created to increase opportunities for adult collaboration as well as support teacher-student relationships. In the second school, all teachers,

adminstrators and secretaries received desktop computers which were networked to increase faculty members' access to each other and thus enhance teamwork.

Methodology

Participant observation underpinned the multi-method approach employed in this study and provided a means whereby both foreground and background activity in the field site were observed and recorded. The cornerstone of the methodology was "shadowing", an observational method involving extended and detailed observation and documentation of the work activities of a teacher team in each school. The goal was to understand how the members of these workgroups accomplished their collaborative work. This methodology provided a unique means to quantify the daily activities of individual workers--to identify and track their tasks, communications, and channel use. This was the foreground; the background was the wider school faculty collaboration, students, and instruction. Since our field research was conducted over a period of several months (11 members of two targeted workgroups were shadowed--6 individuals for 5 days each in the first school, 5 individuals for 6 workdays in the second), we were well positioned for analyzing the background as well as foreground.

ACKNOWLEDGMENTS

The research presented here was made possible by the scientific and financial support of U S West Advanced Technologies. The assistance of Catherine Marshall and Roger Eldridge was instrumental in its success. We greatly appreciate the cooperation of the teachers we shadowed and their administrators, fellow teachers and students. Their willingness to accept our presence and patiently explain their pursuits inspired us to represent clearly the many types of challenging work they take on for their students' sake. Charline Poirier willingly offered encouragement, insight and labor to our project. We are grateful to Sherryl Rosales and Kelly Martinez for their assistance throughout the research and careful preparation of this document.

PART A: REQUIRED SECTIONS

Part A of the Final Report includes brief sections specified for the report in the contract. Part B of the Final Report is the research report itself and contains a description of the project, its findings, implications and recommendations.

Research Results and Extent to Which Objectives of Proposal Met

The basic research plan specified in the project proposal was implemented and successfully carried out. The major objectives of the proposal have been met.

Research results, conclusions and implications are described in full in Chapters 4 and 5 of Part B of this report. Key points include:

1. The nature of teachers' work
2. The structure of teamwork and communication among teachers
3. The constraints of time and space
4. Channel choice and channel switching
5. Multitasking
6. Critical new roles for communication technologies in supporting K-12 schools and teachers
7. The need to support regular classroom teachers and teachers in special roles.
8. The need to support parent-teacher and teacher-social service provider communications
9. School restructuring and its impact on markets and customers with respect to K-12 education

Inventions and Discoveries

The basic research data, the analytical methods applied to those data and the theoretical interpretations given (described in Part B of this report) are the "discoveries" of the project. No patentable inventions or processes are associated with these basic research outcomes.

Critique of Sponsored Research Program

We have found the technical and administrative support provided by staff of U S West Advanced Technologies (AT) to be exemplary. They have been very supportive and have made helpful suggestions concerning the conduct and reporting of the project. Wheen approval, modifications and/or clarifications of specific details of the research plan were required, AT staff facilitated the process.

Communication between AT and project staff regarding related R&D activities of AT and the contractor has been particularly helpful in providing context for the development of the research project. The project has benefited greatly from the insights and participation of Mark Abel as both project sponsor and member of the research team.

Suggested Further Lines of Inquiry

Further lines of inquiry suggested by the research project include (1) examining models of ways the two jobs of teaching can be better coordinated and undertaking further R & D on the potential role of communication and information technology in restructuring education and family-oriented social services; (2) conducting and carefully evaluating a trial of voice mail and voice-based information technologies in a school setting, focusing on the impact of the innovation on all users--parents, teachers, administrators and social service agencies; (3) synthesizing research findings pertaining to workgroup communication derived from this and earlier related studies of marketing (funded by Advanced Technologies) and manufacturing workgroups (with attention to the ways communication technologies might support multitasking, channel switching and other phenomena); and (4) undertaking a more detailed analysis of electronic mail collected in this and earlier related studies; in order to further illuminate needs for and capabilities of this technology in schools and other occupational settings.

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CHAPTER 1
TECHNOLOGY, COLLABORATION AND TEACHERS' WORK

This is the final research report for the project entitled "Group Friendly Interfaces: Application and Customization to Educational Settings." The impetus for our work is the pressing need faced by modern organizations striving to increase or even maintain their effectiveness as they respond and adapt to the growing needs for better information and communication and the powerful technologies supporting them.

In this whirlwind of rapid change, the challenge is to co-design organizations and technological systems which achieve maximum efficiency. Full understanding of organizations and their implementation of technologies is necessary for meeting this challenge. Despite the progress made in designing "user-friendly" interfaces between these technologies and the individual user, and despite the growing tendency to label some technologies as "groupware," there still is an inadequate theoretical and empirical research base for designing workgroup interfaces which are truly "group friendly." As organizations attempt to fulfill their charters, questions and issues of how to best fit the new and existent technologies to the structures of organizations--and the structures of organizations to the new technologies--are of critical importance. Research on the ways members of organizations collaborate, structure their use of time and space and select communication channels is crucially important for design. Also important from both theoretical and practical perspectives are questions of how the structures and characteristics of workgroup interaction are adapted, changed and maintained in relation to these communication technologies.

This project continues our previous research on behavioral criteria for design and implementation of workgroup interfaces to telecommunication and information technologies. A major theme in our ongoing research is the exploration of ways in which time and space constrain and enable patterns of collaboration. In our previous work we have seen that these factors are critical for understanding patterns of group work. Schools provide an interesting setting for the further examination of work patterns given the extreme constraints classrooms and class periods place on communication, movement and the availability and accessibility of co-workers. Thus we apply and develop insights and methods from our research on office work to another distinctive occupational group and setting--teachers in public schools. The fundamental research problem is: How can information systems and telecommunication technologies facilitate professional work in schools? To what extent and in what ways should the workgroup interface be customizable to the particular work styles and activities of teachers? What are the characteristics of effective user interfaces when the user is a team of teachers?

To the end of enabling telecommunication and information technologies to better support schools by meeting the needs of individual teachers and teacher workgroups, the present project aims to:

- contribute to the theoretical and empirical research base for understanding the temporal and spatial micro-structure of activities of teachers in their school organizations.

- refine a model of collaborative behavior and channel choice based on the observation and analysis of relationships among characteristics of teacher workgroups and school environments through in-depth naturalistic studies involving quantitative and ethnographic methods.

- identify and consider the implications and applications of the research findings and theory in order to understand the ways technologies presently serve--and in the future could better serve--school settings.

In the current press of change associated with increased demands for collaboration and emerging technologies of communication, researchers are striving to develop a framework for understanding and guiding group work practices. Within schools this effort to inform and improve practice takes on an added sense of urgency because of the increasing social problems challenging schools and pressures on educators to collaborate more effectively among themselves and with others serving children. The research reported contributes to this exploration by revealing ways the school environment sets potentials for and constraints on teachers' collaboration. In this section we review relevant research on collaboration and technology in the teaching profession and communications in offices.

Literature Review of the Role of Technology in Collaboration

In this section we look at the interplay between communication technology and work environments. Fundamental to this research is the premise that communication technologies have a major effect on the ways work environments constrain and induce collaboration. At the same time, the ways people structure their interaction using the technology affect its impact on their work. We cannot assume one-way causation between technology and its impact, for technology evolves as workers use it (Christie 1985, Kraut et al. 1989).

Small Groups

As an underpinning for understanding the role of technology in collaboration, it is necessary to look at collaboration itself (Malone 1987, Lederberg and Uncapher 1989, Panko 1990). Any technology which supports the group as a whole (as opposed to facilitating specific tasks only) enhances group functioning. But when technological enhancements eliminate the qualities of face-to-face interaction which promote intimacy (nearness, visual cues, etc.), overall group relationships may suffer. The challenge for institutions is to design social organizations which overcome the disadvantage of technology and retain the advantages.

Office Systems

In studying the interplay between groups and their technological support, researchers do not always describe office systems in detail, probably because an organization usually introduces a "package" of innovations including information processing, database and/or electronic mail capabilities, making it difficult to separate the effects of each (Bikson et al. 1981). Here we briefly mention some significant factors which research has shown to be involved in workplace collaboration with these tools.

Productivity. Managers see greater managerial and clerical productivity as a major benefit of innovating in office technology. Other consequences of office automation related to productivity include improved scheduling abilities and higher quality of writing (Rice 1980) and job satisfaction, though not always at all levels of corporations (Bikson et al. 1981, Christie 1985). Along with greater productivity comes greater activity in general, but not all the increase can be assumed to be positive (Rice and Case 1983). McGrath and Kelly (1986) suggest that technology which reduces face-to-face communication also reduces social constraints and connectedness among participants, leading them to concentrate on productivity to the detriment of group-building (in much the same way that time pressure does). To overcome this disadvantage of technology, groups may be able to institute rules for feedback.

Time. Office systems alter the use of time not only by enabling workers to perform work faster, but also by decreasing conversion work, e.g. typing handwritten memos (Butera and Bartezzeghi 1983). Employees may spend the time saved either by redefining their jobs to include additional activities or by devising new applications for the new tools. Butera and Bartezzeghi (1983) predict that the consequences of saved time will be increased speed of innovation. Christie (1985) reasons that time saved will be spread across a diverse range of activities, such as browsing to stimulate creative thinking, discussing and building teams. Most of the research on time and productivity is based on user self-reports rather than observations.

Managerial attention. Studies of managerial attention have emphasized the importance of face-to-face communication (Mintzberg 1973, Sproull 1984, Rice and Shook 1990). Sproull (1984) summarizes the structure of managerial attention: "local, choppy, mostly unscheduled, oral, and as much other-directed as self-directed." From her study (1981) of education managers, she concluded that they interact face-to-face more readily than they read documents. Their attention is directed primarily toward protecting their local programs and making people feel good, but they also tend to be compliant with the higher levels of bureaucracy and willing to focus on the issues of instruction when necessary.

Implementation. In addition to examining office communication systems already in place, researchers have looked at the implementation process. Bikson et al. (1985) perceive a consensus in the literature that the factors influencing adoption and use include reasons for adoption; key actors (e.g., "gatekeepers" and "entrepreneurs"); a critical mass of users in the organization; planning before and during the innovation period; user participation; training and incentives. Factors more specific to the type of organization and occupation of users probably play a role also. Determinants of use for a scientific research community using the Electronic Information Exchange System (EIES) system included individual, system, and groups characteristics (Hiltz 1984).

Occupational culture. One factor operating on implementation is occupational culture. Teachers have been cast as having a "craft culture" (Aquila and Parish 1989) and being less "technocratic" than education change agents who would have them accept certain innovations more rapidly than they tend to do (Wolcott 1977). However, since teachers rarely have access to automated office systems, there is little basis for concluding that they would be inimical to innovation in this realm.

Technological Support for Decision-Making and Cross-Site Groups

Our comprehension of the interplay among technological and social variables is increased by research on teams using various technological enhancements. Research on uses of two of these, group decision support systems (G.D.S.S.'s) and audio/visual (a/v) shared space systems, are described briefly here.

In general, DeSanctis and Gallupe (1987) point out, the benefits which appear to accrue from G.D.S.S. use are affective gains; protocols for decision-making; quality information (e.g., data analysis); integration of technologies; and understanding of the decision-making process. The precise conditions under which these benefits come to the fore are not yet clear, but the level of structure a system provides, characteristics of the group (e.g., size and remoteness of members) and task type help to account for the outcome of groupwork (DeSanctis and Gallupe 1987).

Watson, DeSanctis and Poole (1988) studied influences of G.D.S.S.'s on consensus building by college students. They compared groups using: 1) a computer-structured G.D.S.S., 2) a similar structure provided by paper and pencil, and 3) no support. The structured decision support systems (1 and 2) better facilitated expression of agreement and conflict. But neither structured system increased the equality of individual members' influences. Members of the computer G.D.S.S. group reported less substantial discussion of issues and less understanding of the decision-making process and seemed to have a greater sense of increased distance from one another than did members of the other two groups. They also were less likely to perceive that there was a group leader (in accord with the common assumption that leaders arise to provide guidelines where none exist).

In a cross-site test of shared audio/visual space, employees of Xerox Palo Alto Research Center in two sites separated by hundreds of miles experienced organizational, social and cognitive/physical effects (Abel 1988). In terms of organization, people in both locations experienced group cohesion in spite of distance. In spite of the fact that the information flow between the two sites was not as good as that within sites, they felt that the distributed lab operated as one group. Group members easily continued already-established relationships across sites but initiated relationships and performed certain significant tasks more readily in face-to-face settings. The lack of severe privacy problems seemed to be due to the trusting nature of the group.

Among social effects was the need, when certain standard visual cues were lost, to alter traditional protocols (e.g., turn-taking). With regard to cognitive/physical effects, interactants appeared to adapt to technical limitations rather quickly, feel that those at the remote site were present and orient to audio output more readily than to video output.

Qualities and Uses of Electronic Mail

While the research discussed in the preceding sections focuses on diverse office automation systems, the literature discussed in this section is concerned solely with electronic mail systems. Already a dramatic presence in office environments, they

are being introduced in some schools, including one of the middle schools studied for this report. The promise of email systems goes beyond improved productivity:

> Networks of computers offer a new medium for human coordination, where quantitative improvements in accessibility, velocity, and connectivity will lead to fundamental shifts in how we communicate and how we work." (National Science Foundation-Information, Robotics and Intelligent Systems, Review Panel for Research on Coordination Theory and Technology, 1989, p. 1).

Below we point to some of email's properties as a communication channel and its roles in offices.

Properties of the electronic mail channel. Email shares some properties with both speech and writing. It is similar to all writing in that it is based on symbols which can be saved for a long time, but it also embodies its own particular textual qualities. Most email messages are short (limited to one screen by some systems), often do not include pictures or other graphics, and exist in office environments. Email messages are perceived visually, as are other forms of writing, but can be accompanied by beeps announcing their sending or arrival.

In the relative ease, speed, and informality with which messages can be exchanged, email resembles speech. This fact is highlighted by a description of speech written before the widespread use of email (Tyler 1978):

> To draw the contrast [between understanding a text and understanding verbal discourse] more sharply we need only remember that the paradigmatic act of speaking is the act of an individual, addressing some specific other individual for some reason, at a specific time and place. The meaning of this speech act is distilled not only from what is said, but from the manner, place, time, and means of saying. Even what is said has a different character for it refers to a world, not just of its own making, but one that is there in the existential situation common to the speaker and hearer...(p. 379).

In some respects email "conversation" is like speech as described here, for the sender specifically addresses the receiver and they can collectively construct their meanings. Many forms of writing lack this immediacy which can make email exchange feel like chatting.

Reder and Schwab (1989) analyzed email as a component of a rich "communicative economy" of choices among project teams. Email overlaps partially with other channels (e.g., telephone hardcopy) but takes on unique communicative functions of its own. In addition to comparing and contrasting electronic mail to writing and speech, we also need to examine it in its own right, for it embodies a new constellation of properties. Perhaps foremost among these is its flexibility (which has not received much attention in the literature). Email "correspondents" experience flexibility with regard to the number of users, because they can send to one or more, known or unknown, recipients as well as select which received messages to read. The channel also is flexible in terms of the time dimension, for messages can be written spontaneously or with planning, exchanged synchronously or asynchronously, and saved or disposed of. This flexibility renders the usage and meaning of email highly dependent on circumstances (Fielden 1988).

Content and functions of email messages. Social structure is closely intertwined with communication patterns; therefore any patterned communication change is a structural change. It may never be possible to generalize about the "universal" effects of new lines of communication on the decision-making process or lines of authority because such consequences seem to be a function of the way technology is used in particular settings (Rice & Case 1983). Nevertheless several perceptions common among managers have implications for the structures of decision-making and centralization. In one study, lower-level managers could send messages readily to upper-level managers and believed that computers decreased the amount of time they spent in face-to-face conversations (Bikson et al. 1981). Christie (1985) reports that managers perceive improved decision-making, creation of nonformal structures and increases in complexity of coordination processes, maintenance procedures and rapidity of innovation to be outcomes of computer-mediated systems.

Daft and Lengel (1984) have analyzed media in terms of "information richness," the amount of information and ambiguity they convey. High-level managers, the authors claim, favor "information rich" media (face-to-face conversations being the richest) whereas workers at lower organizational levels need information poor media (numeric written messages being the lowest). Rice and Shook (1990) documented that, in two organizations they studied, individuals in higher job categories were more likely to use electronic mail than individuals in lower job categories. They suggest that

> electronic mail should not be compared to media such as memos and letters, the least information-rich media, but rather to the telephone, which is generally placed in the middle of information richness/social presence scales (p. 220).

A foremost feature of email is the kind of information it does not convey, i.e., the relative paucity of social context cues. As Sproull and Kiesler (1986) have discussed, missing are indications of the sender's and receiver's title, position, affiliation, ethnicity, and so on. Email messages tend to exhibit relative self-absorption and lack of inhibition ("flaming") on the part of the user (Sproull and Kiesler 1986). Situational cues defining the type of interaction the sender and receiver expect (e.g., love note, request for supplies, etc.) also are missing. For teamwork, which relies on group maintenance to accomplish tasks, this sparse indication of social identity and situation is significant. Of course, when email partners also have face-to-face relationships, they are not completely dependent on email for contextual information. Sproull and Kiesler's research was limited to individuals who did not know each other or have other means of communicating, a situation very unlike that being studied here.

Email is not inimical to exchange of messages about personal feelings. Based on the reasoning that contextual knowledge encourages intimacy, one might expect the reduced social context cues of email to discourage communication about socio-emotional content. But in a study of physicians and other medical workers using a computerized bulletin board, Rice and Love (1987) found that: nearly 30% of the total message content was socio-emotional; members in all different positions in the network did not differ significantly in this regard; more active users showed slightly more socio-emotional content and users did not become more socio-emotional over time.

The electronic channel does not appear to hem strong statements in general. Flaming and negative statements are common (Crawford 1982, Kiesler 1986, Spitzer 1986, Sproull 1986). In Sproull's (1986) comparison of data collection methods in a manufacturing firm, more extreme opinions were registered with email than in face-to-face conversation. Spitzer noted used of graphics to communicate strong feelings and flaming on the computer conferencing system in the New York Institute of Technology. However these conclusions are probably better interpreted as reflecting the characteristics of communication through channels for which common etiquette had not been established; such phenomena are less common in settings in which the technology is more adapted (Reder and Schwab, 1989).

Increased office productivity is reported to result from the electronic message systems as from multi-function office systems described above. In studies by Bikson and her colleagues (1981) and Crawford (1982), managers reported that more work was accomplished, although one interviewee questioned the quality of the increased production (Bikson et al. 1981). Secretarial work was considered to be more accurate (1981). Crawford (1982) reported that Digital Equipment Corporation test group users found the electronic system efficient and effective. Managers felt that information exchange was more timely and enjoyed the ease with which they could send messages to many addresses. Secretaries' (not managers') job satisfaction increased. Bikson's (1981) research revealed no major crises or negative impacts resulting from email introduction. Crawford reported that network users in one corporation "felt that by using EMS they were able to accomplish tasks they would not otherwise have done" (Crawford 1982, p. 3).

Email use in organizational context. A set of studies using naturalistic observation methods to look at the constitution of work, personal interaction, and time allocation offers a fine-grained depiction of workgroups' use of available communication channels in the flow of the day's work activities. In a company manufacturing high precision equipment, Conklin and Reder (1985) examined the distribution of interactive work among four channels and found that the proportion of email users in one's communicative network is the most important determinant of one's email usage. Email was highly reciprocal: three fourths of all email messages evoked a response in the same channel. In a study of three workgroups in the marketing unit of a Fortune 500 company (Reder and Schwab 1990a), channel use by groups and individuals was bound up with the entire microstructure of activity and time, including the number of incomplete tasks on a person's desk, the number of tasks worked on each day, and the "compounding" of several topics in one interaction. Reder and Schwab (1990b) further refined the analysis of the intertwining of tasks and interactions among workgroups in two firms in terms of trade-offs between time needed for collaboration with co-workers and time required for solitary work.

In line with these analyses of the complexity of the fabric of work life is the observation that different "media styles" characterize individuals' and organizations' use of communication media (Rice and Case 1983). Norton (1983) describes two senses of individual style emerging from the social science literature: 1) style as giving form to content by indicating how literal meaning should be taken; and 2) style as consistently recurrent communicative patterns. These two concepts of style are applicable to our work on at least two levels: 1) styles of communicators using a particular channel (the electronic channel being particularly interesting in this regard because users are developing styles and protocols for the first time); and 2) over-all style of communicators switching channels as they proceed from one communication to another. On each level an individual is selecting units and

arranging them in sequences in a way that "to a large extent determines self-identity and affects others' perceptions of the individual" (Norton 1983, p. 19). Variations in style "within" a medium, (email, for example) and in style of selecting from among media, (email, memos, and face-to-face conversation, for example) can signal meaning related to the social ranking of participants, task urgency, or some other factor. Reder and Schwab (1988) illustrated patterned differences in workgroup communication related to channel preferences, channel switching and the use of multichannel genres of communication.

Literature Review of Collaboration and Teachers' Work

As the preceding section shows, there is recent research on groups in the workplace and their uses of communication technologies, but up to this time there has been little emphasis in the literature on teachers as members of workgroups, the focus of the present study. However, researchers and practitioners in education recently have taken an interest in teachers' work from a more comprehensive viewpoint than the usual focus on classroom instruction (Goodlad 1984, Rosenholtz 1989, Kidder 1989, Freedman 1990, Ginsburg and Barry 1990, Johnson 1990). Our research also is an expression of this interest in the breadth of activities which comprise the teaching profession. We emphasize the teamwork and communication among teachers and staff which make it possible to plan and coordinate classroom instruction.

Teaching is a very public profession. Most teachers are continually in the public eye--literally, at the head of a classroom and figuratively, at the focal point of public scrutiny of the education system. Yet, paradoxically, as we show in this section, the workload, school culture (including uses of space and time), and pressures to change isolate teachers from others who are serving the same public--their colleagues in teaching as well as other social service providers.

Workload

With regard to workload, Sizer (1985) explains how the sheer amount of work one high school English teacher, Horace, faces prevents him from "reaching" others (and his own high standards) on each particular task. His work day looks like this:

> Horace has his five classes of fewer than thirty students each, a total of 120. (He is lucky; his colleagues in inner cities like New York, San Diego, Detroit, and St. Louis have a school board-union negotiated "load" base of 175 students.)...To check homework and to read and criticize one paragraph per week per student with the maximum feasible corner-cutting takes six hundred minutes, or ten hours, assuming no coffee breaks or flagging attention.... Horace's fifty-some-minute classes consume about twenty-three hours per week. Administrative chores chew up another hour and a half. He will compromise by spending no more than ten minutes' preparation time, on average, per class....Horace's class preparation time per week: four hours....He is paid $800 extra per year to help the student stage crews prepare sets. This takes him in all about four hours per week, save for the ten days before the shows, when he and his crew happily work for hours on end....After dinner, Horace works for an hour on the papers he has brought home and on the Joyce classes he knows are ahead of him once the UN Mock Assembly is over. He has two telephone calls from students...Being a

> popular teacher, he is asked to write over fifty recommendations for college admissions offices each year, a Christmas vacation task that usually takes three full days....Horace would like time to work on the curriculum with his colleagues...visit their classes and work with them on the English department program...to meet his students' parents, to read in his field, and, most important for him, to counsel students as they need such counseling one on one (pp. 17-18).

This pace is common in the school world. A common consequence is the loneliness of teaching: "Teachers [spend] most of their working lives away from colleagues, supervisors, administrators or other adults" (Palonsky 1986, p. 175). Observers in schools tend to echo this observation, autonomous teachers (Johnson 1990) noting the "crushing effects" of isolation (Ward 1989, p. 1). Recognition of the ill effects of lack of communication has been a major factor behind the move to plan cooperative work.

School Culture

Behind the occupational duties and opportunities described above are traditions of school organization which contribute to the isolation teachers experience. These include the lack of mechanisms for resolving conflicts over curriculum and teaching styles; job definitions independent from school goals; heterogeneity of faculty (purposely composed as an "academic buffet" for students to sample); bells signaling changes in work mode; lack of contact with universities; and subject supervisors intermediating between teachers and administrators (Palonsky 1986). Additional factors keeping teachers apart are described below.

Most professionals have offices. As Wolcott (1977) points out,

> People who have offices usually accrue a number of other advantages that can be invaluable in getting work done: privacy; access to telephones, typewriters, and materials; and a home base that is not occupied by others, to name a few. Teachers' offices are their classrooms (p. 179).

Of course these "offices" are usually full of students and therefore do not accommodate teachers' need for privacy. Moreover, since classrooms are bigger than most offices (even though teachers have only small spaces in them to use for their own work) they distance teachers from each other. In a five-minute break between classes with several business items to handle, a teacher can walk only so far to contact a colleague.

Teachers enact "school time" which has its own distinctions. Hall (1984) has increased our awareness of the cultural nature of concepts of time, i.e., how humans create their understandings of this dimension of experience rather than simply receiving them from the physical world. Dubinskas (1988) and others have analyzed constructs of time various occupations have developed. Among physicists, for example, Traweek (1988) reported a set of conceptions of time (related to cosmology, knowledge, scientists, laboratory and detectors) which the professional community used to organize their social interaction. Time is socially constructed by and for educators also.

> Time structures the work of teaching and is in turn structured through it. Time is therefore more than a minor organizational contingency, inhibiting or facilitating management's attempts to bring about change. Its definition and imposition form part of the very core of teachers' work and of the policies and perceptions of those who administer such work (Hargreaves 1989, p. 1).

The Nature of Time in Schools (1990), edited by Ben-Peretz and Bromme, reveals ways time categories are imposed upon and perceived by teachers in specific settings. In this volume, Kischkel (1990) analyzes noninstructional time, the focus of our research. He measured time spent on preparation, administration and reduction of teaching obligations, reporting that interactions among conservatism, gender, age and other variables to affected teachers' job satisfaction and stress.

The rigid school schedule promotes teachers' physical isolation. Long class periods (with prescribed locations, tasks, and participants) are dramatically punctuated by short breaks. Erving Goffman's (1959) analysis of social interaction as a "performance" with a "stage" and "behind-the-scenes" activities is pertinent here. Teachers, when they are not "on stage" in front of students, often are isolated from other teachers and administrators with whom they tend to engage in informal "backstage" interaction. Any distance-spanning device for teachers to use while they are "stuck" in their classrooms increases their time for social interaction. The ability to communicate informally in the private "backregion" is an essential activity for coordination (Hargreaves 1989, Kraut et al. 1989).

The artisanry that is part of teaching disposes teachers to guard their privacy (Huberman 1990). "Teaching is a complex craft, one class never being quite the same as another" (Sizer 1985). Recognizing their individual creative efforts, it is easy for teachers to overlook the potential for collective enterprise to accomplish either mundane or creative work.

Common symbols of respect in our society--autonomy, money, and prestigious prizes--generally are not associated with teaching (Sizer 1985). Teacher autonomy varies but always is constrained by schedule and other factors discussed above as well as by management and curriculum requirements. In light of their obligations and working conditions, teachers' salaries are relatively low (Freedman 1990). As Sizer (1985) points out, they are tied to market value and comprise 75% - 85% of most school budgets. Typically, salary schedules take account of years of experience and post baccalaureate credits, but not teaching ability. The only promotions available are into administration, but they are scarce and not desirable opportunities for many who prefer classroom interaction. Teacher-of-the-year awards are the only educator prizes the media highlights, and these are not accompanied by material reward (Palonsky 1986).

Even pressures to change can isolate teachers from one another. Administrators and researchers have exhorted teachers to improve student outcomes, build schools that "work" as organizations, solve social problems (by providing a stable, nurturing environment, instilling values, and so on) and enhance professionalism by changing their individual styles or materials. In *Teachers vs. Technocrats* Wolcott (1977) expresses this:

> One can even detect a note of inevitability in the comment of the teacher who said, "In our district it's going to be SPECS [an innovation for teachers to implement]; somewhere else it will be a different program." The sequence is

> set; while the technocrats look for ways to change education, the teachers muster their forces as necessary and wonder half aloud, "What next?"

In developing the complex social and political skills entailed in education improvement, teachers receive little or no training; as a result many remain apart, trying to improve as individuals rather than forming alliances. Training for the instructional component of their work emphasizes this self-reliance. Relative to the training in many professions, teacher training is brief and requires only a short internship. Immediately after completing undergraduate training, including a short period as a student-teacher, the new teacher typically is responsible, with no transitional period, for a full slate of classes and related duties. "One result of this compressed socialization into the profession is that teachers rarely, if ever, turn to evidence beyond their own personal experience to justify concrete experience with particular students in fixed locales" (Weinshank et al. 1983: 307).

In spite of both the lack of training for working in groups and the thrust from "the top" for individual improvements, there are many cases in which teachers strive independently from "management" to alter schools. One career elementary teacher's strategy for introducing innovation is an example:

> I feel quite comfortable about my ability to effect change in my elementary building. It does take a certain amount of skill however....First, mention your concerns quietly to one or two staff members who probably wili agree with you....Do a mental sociogram concerning the people in your building....[You must choose] the right person to present your concerns and solution in a dynamic fashion. If you see that proper spark of enthusiasm, leave quickly on some pretense and come back to it a few days later. The next time offer to write all the proposals and gather needed information....You'll supply the coffee and doughnuts....Design evaluations that don't take a lot of time to fill out by the teacher....With luck and a lot hard work the project may still be going in some fashion in five years (Weinshank et al. 1983: 304-307).

Increasing Collaboration Among Teachers

Both expert and grassroot (teacher) reformers are moving forcefully to increase cooperation among people in a variety of different roles. Currents contributing to this stream include peer coaching among faculty and administrators; site-based management of individual schools by principals, teachers, parents and others; site-based improvement programs of individual schools by principals and teachers and cross-disciplinary planning teams of teachers within schools. Although diverse, these innovations share the common aim of increasing the times, purposes and quality of social interaction in schools in order to increase student learning. The thrust is <u>not</u> team-teaching <u>in the classroom</u>, but teamwork <u>during noninstructional time</u> for planning policy and curriculum and professional development. Teachers' growing awareness of their professional seclusion is fueling the call for structural changes to promote communication among peers and across organizational levels (Lieberman 1988).

This movement toward cooperation among adults runs parallel to a different movement toward structuring cooperation among students in the classroom. Cohen (1986), a leading proponent of cooperative learning, describes its merits:

> Groupwork is an effective technique for achieving certain kinds of intellectual and social learning goals. It is a superior technique for conceptual learning, for creative problem solving, and for increasing oral language proficiency. Socially, it will improve intergroup relations by increasing trust and friendliness. It will teach students skills for working in groups that can be transferred to many student and adult work situations. Groupwork is also a strategy for solving two common classroom problems: keeping students involved with their work and managing students with a wide range of academic skills (p. 6).

The two school reform agenda items of structuring cooperation among students and among adults are closely related, as explained by another leader of cooperative education, David Johnson (Brandt 1987):

> Cooperation needs to start at the classroom level because that determines the organizational climate and atmosphere in the district. If teachers spend five to seven hours a day advocating a competitive, individualistic approach...those are the values the teachers are going to have in their relationships with colleagues and their administrators. On the other hand, if teachers promote cooperation among students they will look at their colleagues as potential cooperators.

"Colleagueship" or "collegiality" is a frequently used term for the kind of relationship many believe teachers should be forging among themselves. It is based on the view that:

> the likelihood of education innovations being successfully implemented depends on (1) having enough time to plan, implement, and evaluate new projects, (2) promoting collegial involvement and cooperation, (3) establishing links with outside professionals, and (4) securing long-term project support from administrators (Weinshank et al. 1983).

Examples of nontraditional collegiality abound, representing various professional roles, levels of organization and degrees of interdependence. One school, following a program for school improvement called Onward to Excellence, enacted a research-based, schoolwide goal-setting process which affected text purchasing, grading policies, curriculum coordination and teaching practices (Kneidek 1990). A high school faculty attempted to overcome isolation and improve student achievement by sharing the knowledge base for teaching and learning (Ward 1989). At another organizational level, district principals structured a project to improve instructional leadership by means of peer teams whose visits to each others' schools became the basis for mutual learning (Kline 1987).

An increasingly common extension of the collegiality concept is collaboration between researchers and teachers. In a project designed to clarify teachers' perspectives on leadership, university faculty and local teachers enhanced two kinds of colleagueship--that between professors and teachers, and that among teachers (Wasley and McElliott 1989).

Colleagueship is said to be part and parcel of "the collaborative school." Such a school is characterized by: 1) structures whereby teachers and administrators work together to determine school goals and implement them; and 2) convictions that the school as an institution plays a large role in determining the quality of education and that teachers are responsible for the instructional process and should work together to improve their instruction (Smith 1987). No general consensus has yet developed as to which units of an organization most effectively collaborate (Huberman 1990) and the purposes and degrees of interdependence (Campbell 1990; Little 1989).

Middle schools (the level of schooling examined in this project) have had a high profile in the movement for collaboration and colleagueship. Experts advance "the middle school concept"--a set of innovations which fits current thinking on the needs of early adolescents and the needs of educators to break out of isolation (Lounsbury 1984, George and Oldaker 1985, Alexander 1987, Filby 1990). Under their plans, a faculty reorganize themselves into cross-disciplinary teams, each responsible for a subset of the school's students. The teams collaborate to design and implement curricula, handle cases of individual students with special needs, organize events, and perform other duties. From 1968 to 1988 the percentage of middle schools in the U.S. utilizing inter-disciplinary teams of teachers in this manner rose from around 5% to around 30% (Alexander and McEwin 1989). Much of the research on teams describes exemplary sites.

A social science concept with great promise for illuminating teamwork is that of networks. On a cross-disciplinary team, each member is in a web of relations with others members and belongs to a broader network with other school personnel not on the team. The network approach focuses on the relationships among individuals rather than their characteristics or roles (Wellman 1983, Rice and Love 1987, Contractor and Eisenberg 1990). Using networks, we can examine the differences among (and changes in) relationships in terms of strength and numbers of ties. By visualizing communication as networks rather than as quantities of information being exchanged, we form an image of convergence of many lines of communication rather than lines along which some "thing" is passed (Rogers 1986).

Since five to ten teachers comprise a typical middle school team, the extensive body of research on small groups (Hare 1976, Zander 1985, McGrath and Kelly 1986) contributes to an understanding of team interaction. This research clarifies how small groups are comprised of associations among members whose communication and performance are influenced by motivational factors (pride, quality of procedures, incentives and others) and structural factors (position, status, workload and others) (Zander 1985). Ongoing groups must carry out three functions: 1) production; 2) member support; and 3) group well-being. Time constraints and the nature of the task to be performed have great effects on small group performance (McGrath and Kelly 1986). If time pressures (which loom so large in school reality) become too great, they limit a group's attention to anything beyond production, resulting in inattention to group processes. [1]

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1 For insight into the challenges which new technologies pose for communication in small groups, we are indebted to Joseph E. McGrath for his remarks at the Lewis and Clark College Conference on Small Group Research, 1990.

Summary

The literature cited above demonstrates the interplay between the social organization of work and technology. Just as teamwork and technology influence the patterns of time, productivity and social structure in professional offices, they will affect these dimensions of work as they are introduced in schools. It is possible that technological enhancements of teamwork will do more than merely help teachers to accomplish customary tasks more efficiently; technologies may allow teachers to meet the profound social challenges of their roles and influence their basic assumptions about the nature of mind and work. The new channels have potential for reducing isolation, enhancing professional identity and increasing effectiveness in individual and collaborative tasks. One possible consequence of enhanced capabilities for communication is the strengthening of teachers' own contribution to and participation in the change process. For example, having a "personal" computer can mean "networking" to a teacher, opening the door for increased participation in all spheres of education. (In the 1980's social reformers did not use the then new non-networked home computers to create networks and decentralize information sources as much as develop a vague sense of personal control over information (Turkle 1984, Siegel and Markoff 1985).)

But technology does not usually *cause* social forms and ideas. In fact, social organization usually "leads" technology: workers use new tools primarily (not exclusively) for established functions (Rice 1980, Hiltz 1984, Siegel and Markoff 1985, Contractor and Eisenberg 1990). What people already *do* is a major determinant of technology use. Therefore the study of teachers' tasks and patterns of communication is an essential underpinning for development of technology to support them.

CHAPTER 2
METHODOLOGY

This report presents findings of an empirical study designed in such a way that quantitative and qualitative methods enhance each other. In this section we explain the methodological approach, the specific techniques employed and their relationship to the kind of understanding produced.

Participant Observation Approach

In terms of data collection techniques, our research fits within the tradition of the ethnographic approach. Spindler and Spindler (1987) outline the criteria for good ethnography. It should be based on prolonged, repetitive observations of behavior in its naturally occurring context. Natives' socio-cultural knowledge (both explicit and implicit understandings) are elicited. In asking questions, the researcher tries not to predetermine the responses. Hypotheses, research agenda and instruments are developed in the field rather than being formulated prior to the fieldwork and imposed upon it. An unstated assumption behind the approach is cross-situational comparison, a broad perspective which illuminates a set of behaviors as a particular human adaptation to common human social and cultural needs.

The above criteria should be understood as a set of interrelated outlooks, theories, and practices which constitute ethnographic intent. Specific research activities (e.g., interviewing, observing, counting instances of particular behaviors) do not in themselves constitute ethnographic work:

> It is important to distinguish between "ethnography" and "field work"...."field work" is a suitable general term for any contact with people as sources of information;...not all "field work" in this sense is "ethnography"....contact, having been there, is not enough....when anthropologists limit their inquiry to observations and questions for which the set of alternative answers is already fixed, I should like to say that that may be field work, but not ethnography (Hymes 1977, p. 170).

In this vein, although not all ethnographers agree about the roles of natives' meanings and the possibilities of interpretation, there is common agreement that underlying patterns, whether broadly cultural or social or in the immediate interaction, are essential for understanding natives' and observers' sense-making.

Originating during the European and American political and economic expansion of the late 19th Century, ethnography was an attempt to understand and interpret societies and cultures foreign to Westerners. In order to form predictable relationships among "strange" peoples it was necessary to take on the challenges of finding their essential meanings and "mapping out" their social structures. Ethnographers took on these challenges through the research stance termed "participant observation"--living among those studied and sharing their pursuits as closely as possible.

Fieldwork activities, then, depended on the research population and project goals. In a village of a small-scale society, an ethnographer typically started out by making a map; taking a census; interviewing key informants; charting kinship; observing

rituals; participating in village events; and collecting life histories, folklore and cultural history (Crane and Angrosino 1984, Williams 1967, Pelto 1970).

This theoretical and methodological approach of ethnography, relying on participant observation fieldwork activities, was adapted in the latter half of the 20th Century for research on diverse societies, including urban societies and populations more familiar than those on distant continents (Gans 1982, Stack 1975, Pilcher 1972). Insights, again, were rooted in the relatively thorough, holistic depictions of people in real situations where multitudes of interacting factors and processes of change could be represented in a way that research concentrating on a few factors across many cases could not do. Researchers designed instruments for attaining specific knowledge, e.g. the Instrumental Activities Index the Spindlers created to elicit informants' responses concerning traditional and modern values in a German village Spindler (1974).

By the 1960's the merits of this approach for the world of education were recognized. Much education research in the 1950's had been based on the model of controlled experimental research psychology; some scholars of education welcomed the wide angle lens provided by ethnography. Aside from methodological influences, their adoption of the ethnographic model also was influenced by the anthropological tradition of studying underprivileged populations and emphasizing socialization processes, both topics central to U.S. public education. The ethnography of education shares the property of all ethnography in that it presupposes a theory of the interrelatedness of all aspects of society, their underlying meanings, and symbolic expression. Thus the methodology used in this project is derived from this research tradition.

Key Methodological Issues

In all scientific endeavors, the issues of measurement, objectivity, and generalization arise. They especially loom large in the study of human behavior because of the dual challenge of understanding complex human meaning systems and using humans as a "tool" for studying our own species.

Measurement

From the intellectual position of ethnographic intent and the social (and physical) position of a participant observing, the "rivalry" between qualitative and quantitative methods becomes pointless. Just as the belief that the final test of qualitative insights comes when they are subjected to quantitative experimental design is unfounded, so is the inverse belief that measurement and experimental design can only complement and come after "deeper" findings obtained by other means (Hymes 1977).

One reason that ethnographic fieldwork is not in conflict with statistically oriented research (Spindler and Spindler, 1987) is that it can include, draw attention to the need for or answer questions pointed out by quantitative inquiry. This has been true throughout the history of anthropology. In 1889 Tyler forged the union of measurement and qualitative description by calculating the probabilities of association of various traits across cultures, thereby advancing the understanding of their functional interrelationships (Harris 1968). Barnett (1983) also "could not ignore the implications of precision inherent in" mathematical representation (p.

159). In a study of Oregon tribal groups, he used numerical catalogues of traits associated in separate cultures to calculate degrees of similarity between the nine areas under investigation. Thus the qualitative work of listing and understanding traits yielded holistic comprehension of culture only after numerical analysis.

Subjectivity and Objectivity

With regard to interaction between researcher and subjects, social scientists of the last decade have become more aware of and refined the ways in which the discourse between ethnographer and "native" produces knowledge (Clifford and Marcus, 1986). Rather than either subjectivity or objectivity, ethnographers seek intersubjectivity, i.e., renderings which natives, researchers and their audiences can understand.

The supposed subjectivity/objectivity opposition, another object of concern in social science, is expressed by Margaret Mead as follows:

> In this conflict between those who attempted to mechanize the intelligence and skills of the observer and those who tried to make the most of the idiosyncratic skills and intuitions of the observer, by enlarging and deepening the observer's self-awareness, anthropologists occupied a middle ground" (1977, p. 3).

Behavioral scientists, the claim has gone, are able to balance this dichotomy: Given rigorous training and "delicate and precise" recording methods, they are able to "bring back from the field records of unique, subjective informed experience which can be analyzed and later reanalyzed in the light of changing theory" (Mead 1977, p. 7).

However, this view of each "bit" of knowledge as positioned along a continuum ranging from extremely objective to extremely subjective is currently giving way to a view of all knowledge as the product and producer of the reality from which it comes. This view unites social scientists' endeavors with those of 20th Century natural scientists who often work with indirectly testable entities (e.g., subatomic particles) and differences, patterns and structure (e.g., information) rather than things and their qualities. In the analysis of these sorts of phenomena, intuition, inference, metaphor and interpretation often play a significant role, as described by Watson (1968) in Double Helix: Being a Personal Account of the Discovery of the Structure DNA. The perspective of the observer becomes ever more closely bound to the phenomena and the results of the study. Balancing objectivity and subjectivity is now less the aim than is understanding the total research process, including the "immersion" of the researcher "in" the data and the resulting data (Keesing 1976).

Generalizability

The issue of generalizability arises in ethnography:

> From the standpoint of a science dedicated to generalization and universals, the specifics of each world may seem simply boundary conditions, specific constants and ranges to which the parameters of general theory must be adjusted. From the standpoint of a science imbued strongly with a historical sensitivity, the specifics may contain

> qualities of emergence. To the one view, qualities that are rare or unique may seem something that can be set aside because of their infrequency (Hymes 1977).

Solid analysis of a particular social system and how it operates has value in its own right and in many cases precedes work addressing larger numbers of cases. By making statements "close to the behavior", one can highlight meaning and structure in a profound way. Where generalizations do follow, they are based on the insight of interrelationships.

In sum, the extreme polarization of quantification versus qualitative study, objectivity versus subjectivity and the general versus the particular are not in tune with the holistic and interpretive aims of ethnography. As Geertz (1983, p. 9) notes:

> So far as the social sciences are concerned, all this means that their oft-lamented lack of character no longer sets them apart. It is even more difficult than it always has been to regard them as underdeveloped natural sciences, awaiting only time and aid from more advanced quarters to harden them, or as ignorant and pretentious usurpers of the mission of the humanities, promising certainties where none can be, or as comprising a clearly distinctive enterprise, a third culture between Snow's canonical two. But that is all to the good: freed from having to become taxonomically upstanding, because nobody else is, individuals thinking of themselves as social (or behavioral or human or cultural) scientists have become free to shape their work in terms of its necessities rather than according to received ideas as to what they ought or ought not to be doing.

The Fieldwork Process and Data Collection Methods

The data reported here are drawn from a field study of two schools. Although modest in time and scope, the intent is ethnographic as defined above in that it seeks to identify natives' meanings, tacit knowledge and behavior patterns and to do so by being on relatively intimate terms with the people in their natural surroundings without posing rigidly predetermined questions. Focusing on one aspect of one role (teachers' collaboration), it uses the participant observation research approach. We chose this approach because of the need for "a solid understanding of what kinds of groups exist in organizations" as a basis for designing and applying information and other communication technologies (Panko 1990).

This project is an extension of previous research which employed the same methods to study a range of workgroups, with emphasis on team collaboration and use of varied communication channels (Reder and Schwab 1989, 1990). Carried out among workgroups in various settings, including teams of hardware and software engineers in a manufacturing firm and senior managers in a division of a Fortune 500 company, they offer a fine-grained analysis of the flow of work across time, locations and from one person to another, opening the way for similar analyses in contrasting settings. Teachers, as members of workgroups, are involved in a complex mix of activities, of which classroom instruction is only one part; the amounts and kinds of non-instructional work in schools, while not widely recognized, are crucial characteristics of these work settings.

We sought to build on and extend our previous research as we studied teacher teams' collaboration in orchestrating their instruction, curricula, management of special student cases and student activities. We identified several criteria for selecting schools as potential research sites.

- o School has teacher teams actively collaborating on particular task
- o School is accessible to the researchers and staff are interested in research which can improve their collaboration
- o School has implemented specific strategy for facilitating collaboration (strategies contrast across schools)

In searching for alternative schools which met these criteria, we learned of Oak Bluff Middle School [2] which had introduced computer-mediated communication for supporting teacher communication and collaboration through electronic attendance, bulletins, shared files and messages. This unusual strategy of using a new communication channel in a public school to support collaboration was of great interest. We then sought a comparable middle school which emphasized a different strategy to facilitate collaboration. We selected Mountain View school, which was in the first year of implementing a division of the faculty and students into four major "neighborhood" teams, a social and "geographical" rather than a technological strategy.

As in the previous field studies of other occupational groups, research in each site proceeded through two phases: informal and formal. During the informal phase in each school, we made many visits to the schools to observe and talk with personnel. In this early stage we observed many classes and took extensive fieldnotes, attended full faculty and team meetings, ate in the faculty lunchroom with teachers and toured the buildings alone and with administrator guides. By this means, we advanced the fieldwork in several ways. First, we achieved fundamental knowledge of the social organization, tasks, roles and schedules of teachers, enabling us to select a target team in each school. Second, we developed rapport with faculty, one result of which was that, without pressure from the administration, team members readily granted us permission to study them. The one exception was a soon-to-be-retiring teacher who did not care for the continual close contact our method requires; he said he felt that his work was insignificant for research because it was his last year of teaching. Though we attempted to convince him that his participation would contribute to our study, he declined to do so. Finally, we adapted and refined the previously developed instrument to fit the current research setting: the instrument which had been used in previous projects to structure observations among other occupational groups was fit to the time categories, event types and communication channels of the schools.

Having laid the groundwork by formulating mutually enhancing qualitative and quantitative methods and establishing the positive social relationships advantageous for thorough fieldwork, the second, more formal and structured phase of data collection began. A team of three researchers conducted observations in each school for six weeks.

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2 Pseudonyms are used for these and all other names of institutions/organizations and individuals throughout the report.

Shadowing

The greatest amount of research time in the formal phase was spent in shadowing, a data collection activity which entailed following selected workers (teachers, i.e.) for an entire day at a time. Observations made while shadowing were recorded on a structured data collection instrument (Figure 2.1). Shadowing enabled the researchers to form rapport, observe widely and carry out two other data collection activities: informal interviews and document collection. Three researchers (two male and one female) shadowed team members for a total of 30 sessions in each school (researchers spent five full days shadowing each of the six target teachers in the first school and six full days with each of the five target teachers in the second school). Most of these workdays lasted from approximately 7:00 a.m. until 4:00 or 5:00 p.m. We did not follow the same person two times in a row. We gave several days' advanced notice of an upcoming shadow day to the target teacher and offered to postpone the date if necessary (for example, because a substitute would be in his or her place) or desirable (due, perhaps, to not wanting constant company). No teacher ever requested postponement for the latter reason.

A researcher shadowed a teacher by arriving at school and proceeding to each location the teacher visited during the entire day, observing all the activities and recording his or her activities on the structured observation record. The detailed protocol for coding observed behavior on this sheet is presented in Appendix A.

The structure of work in a teacher's day is based on tasks. We define teachers' *tasks*, from the perspective of the subjects, as discrete work objectives (e.g., writing a lesson plan). Tasks were accomplished by teachers through *events*, which we define as observable actions. Viewed within the context of collaborative work, we discriminate between events which are communicative (e.g., speaking to a parent over the telephone) and those which are non-communicative (e.g., using a calculator). Tasks may begin and end with a single event or may continue over time. Tasks and events cluster in particular ways; these clusters we refer to as episodes. *Episodes* are defined as units of temporally bounded activity, and can be further divided into simple and compound forms. A *simple episode* is defined as a unit of temporally bounded activity involving a single task and event which may or may not involve communication with other individuals. If the simple episode is communicative, it is restricted to a single channel. A *compound episode* is defined as a unit of temporally bounded activity which may involve more than one task and/or more than one event (e.g., a face-to-face conversation with another teacher [the first event] pertaining to a classroom management plan [the first task] in which the subject creates for the other interactant a pencil sketch of the plan [the second event] followed by further discussion of an unrelated discipline problem [the second task]). As this example shows, compound episodes may involve more than one channel (i.e., information is carried simultaneously through face-to-face conversation and documentation). Similarly, multiple tasks can be addressed through a single event (e.g., a face-to-face conversation may involve discussion of several discrete tasks).

Examples of Shadow Observation Coding

Figure 2.2 is an example of the coded behavior of a Mountain View teacher, Molly Schneider, showing that before class started ("b" under "time category") at 9:13 ("start time")in

Teacher: _____

Date: _____

NWREL Shadow Observation Sheet

Researcher: _____

Page ____ of ____

Time Categories:
c=class
ps=passing
b=before school
a=after school
l=lunch
pp=prep

C=continuation of prior event

Event Types:
w=work
o=personal business
f=face-to-face
dt=ditto
pt=printing
x=photocopying

tc-temp. display created
to-temp. display observed

pdc=perm. display created
pdo=perm. display observed

p(r)=phone call
pm(r)=phone message
pb(r)=phoned back

it(r)=intercom message

Event Types with Documents:
er=electronic document received
ero=electronic document received, observed
eo=electronic document observed
ec=electronic document created
e=electronic document sent

dhr=document sent by hand, received
dur-document sent US mail, received
dsr=document sent school mail, received

dhro=doc. send by hand, received, observed
duro=doc. sent by US mail, received, observed
dsro=doc. sent by school mail, received, observed

do=document observed
dc=document created

dh=document sent by hand
du=document sent by US mail
ds=document sent by school mail

Abbreviations:
document type:-
e=electronic document
d=hard copy document

channel:-
h=hand transmission
u=US mail transmission
s=school mail transmission

operations on document:-
c=create
r=receive
o=observe

(f)=failed attempt at communication
(s)=scheduled communication

Time									Participants (Circle Initiator)			Use circled numbers to point to fieldnotes. Indicate type of document
Time Category	Start Time	Continued Event	Location	Clustered Events	New Episode	Event Type		Task Number		Mediated	Prior Event	Comments/Notes

FIGURE 2.1 SHADOW OBSERVATION RECORD
(80% Original Size)

Teacher: Molly Schneider
Date: 5-7-90

NWREL Shadow Observation Sheet

Researcher: SH-L
Page 9 of 18

Time Categories:
c=class
ps=passing
b=before school
a=after school
l=lunch
pp=prep

cp=continuation of prior event

Event Types:
w=work
o=personal business
f=face-to-face
ds=dsso
pt=printing
x=photocopying

ic-temp. display created
io-temp. display observed

pdc=perm. display created
pdo=perm. display observed

p(r)=phone call
pm(r)=phone message
pb(r)=phoned back

i(r)=intercom message

Event Types with Documents:
er=electronic document received
ero=electronic document received, observed
eo=electronic document observed
ec=electronic document created
e=electronic document sent

dhr=document sent by hand, received
dur-document sent US mail, received
dsr=document sent school mail, received

dhro=doc. send by hand, received, observed
duro=doc. sent by US mail, received, observed
dsro=doc. sent by school mail, received, observed

do=document observed
dc=document created

dh=document sent by hand
du=document sent by US mail
ds=document sent by school mail

Abbreviations:
document type:-
e=electronic document
d=hard copy document

channel:-
h=hand transmission
u=US mail transmission
s=school mail transmission

operations on documents:-
c=create
r=receive
o=observe

(f)=failed attempt at communication
(s)=scheduled communication

Time: Time Category	Time: Start Time	Time: Continued Event	Location	Clustered Events	New Episode	Event Type		Task Number	Participants (Circle Initiator)	Mediated	Prior Event	Use circled numbers to point to fieldnotes. Indicate type of document. Comments/Notes
b	9:13		109		✓	f		42	(Moffitt)			Moffitt asks her to keep an eye out for something he lost.
b	9:14		"		✓	w		0	-Moffitt			(Moffitt gone) Molly cleans overhead projector and leads class.
—	9:15	—	B E L	L		(signals		beginning of	class)			
c	9:16		"	*	✓	do		1				attendance: reads names
c	9:16		"	*		dc		1				and marks on sheet
c	9:16		45			ds		1				posts attendance form in hall for school mail pick-up
c	9:17		109		✓	sf		21	(Smith)			Smith enters to help students forecast courses for next year.

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FIGURE 2.2 SAMPLE SHADOW OBSERVATION RECORD FOR MOUNTAIN VIEW SCHOOL
(80% Original Size)

room 109 ("location") she engaged in a new episode ("√") by talking ("f" in event type) with Mr. Moffitt (a teacher under "Participants") regarding a piece of paper he was looking for ("Task Number" 42). (The complete coding protocols appear as Appendix A). The circle around "Moffitt" indicates that he initiated the interaction. In this case he came into her classroom in the minutes before class officially started in order to ask her about it. When Moffitt left, Molly started cleaning the overhead projector and telling the class about their work. This type of activity, not directly related to interactions or collaboration among workers or other adults, is coded as "work" ("w"). Then the bell rang. As class began ("c" under "time category") Molly started ("√" under "new episode") to take roll. By alternately reading the list of names and writing on it ("do" and "dc"), she enacted one episode which was a combination of intrinsically related event types ("*" under clustered events column). The roll-taking episode continued as she moved into the hall ("45" under "location") to post the attendance in the hall for the school mail. All of the events (lines, or records of behavior) relating to roll have the same number ("1"). Upon re-entering her room, Molly greeted Ms. Smith whom the office personnel had scheduled to arrive at this time ("sf" under "event type") to guide the students in selecting next year's courses.

An example from Oak Bluff (Figure 2.3) illustrates the coding of electronic along with other channels. Vicky Morales, English teacher, was evaluating students papers ("w") during a passing period. When the bell rang beginning her prep period she continued the same work until she received and read two email messages ("ero 30" and "ero 19"), one from an aide telling her that the envelope circulating for money for retirement gifts had been lost, the other from the vice principal about summer planning of literature and language arts curriculum. (Note the aide does not have her own email account but uses the machine in the resource room. Thus her message appears at first glance to be from Mrs. Kovak, the resource room teacher). Vicky began to create a reply to Mrs. Miller's message ("ec 19") that she did want to participate in the summer planning and then went on to a new topic ("ec 22"), writing that she would like to see a certain teacher hired next year. A student walked in and handed her a hat, asking her to give it to a boy in one of her classes ("w"). She went back to her screen and finished writing about the hiring ("ec 22"). Notice that the resumed activity is coded with a "c" to indicate the continuation of an event which was interrupted. Then she sent the message to the vice principal (the two "e" event codes mark the completion of the episode). Next she read a document ("do 23") she had received earlier from the office asking her to recommend the student who brought it to her to run for student body office. She wrote on the document ("dc 23") her evaluation of the student's eligibility to run.

Interviews

Many extensive, in-depth interviews with each targeted teacher yielded ample information on teachers' activities, attitudes and opinions. In order to elicit topics of concern to the teachers themselves and encourage sincere, complete coverage, we did not approach interviews with schedules of questions, but when we needed elaboration or clarification of something we had observed, we did introduce topics. Interviews ranged in degree of formality as personal relationships with participants developed. We rarely took fieldnotes during the interviews, for fear of hampering the flow of information, but made notes immediately afterwards (while the teacher attended to something else) or after leaving the school.

Teacher: Vicky Morales
Date: 5-16-90

NWREL Shadow Observation Sheet

Researcher: SH-L
Page 13 of 20

Time Categories:
c=class
pa=passing
b=before school
a=after school
l=lunch
pp=prep
cp=continuation of prior event

Event Types:
w=work
o=personal business
f=face-to-face
dt=ditto
pr=printing
x=photocopying
tc-temp. display created
to-temp. display observed
pdc=perm. display created
pdo=perm. display observed
p(r)=phone call
pm(r)=phone message
pb(r)=phoned back
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Event Types with Documents:
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eo=electronic document observed
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dur-document sent US mail, received
dsr=document sent school mail, received
dhro=doc. send by hand, received, observed
duro=doc. sent by US mail, received, observed
dsro=doc. sent by school mail, received, observed
do=document observed
dc=document created
dh=document sent by hand
du=document sent by US mail
ds=document sent by school mail

Abbreviations:
document type:
e=electronic documents
d=hard copy documents
channel:
h=hand transmission
u=US mail transmission
s=school mail transmission
operations on document:
c=create
r=receive
o=observe
(f)=failed attempt at communication
(s)=scheduled communication

Time: Time Category	Time: Start Time	Time: Continued Event	Location	Clustered Events	New Episode	Event Type		Task Number	Participants (Circle Initiator)	Mediated	Prior Event	Use circled numbers to point to fieldnotes. Indicate type of document. Comments/Notes
ps	12:20		8		✓	w		∅				correcting papers, making test, entering grades
—	12:25	—	B E	L	L	(signals beginning of prep period)						
	12:49		"		✓	ero		30	Easton (on Kovacs' account)			$ for presents for retiring persons - envelope's lost
"	12:49		"		✓	ero		19	Miller			summer planning for literature + language arts - Vicky could contribute a lot.
"	12:50		"			ec		19				Yes, Vicky would like to participate.
"	12:51		"			ec		22				Is any hiring taking place yet? Vicky would like to see Green hired.
"	12:51		"		✓	w		∅				kid comes in with hat- asks Vicky to give it to boy in her class.
"	12:51	c	"			ec		22				more writing on reply to Miller
"	12:52		"			e		19	Miller	12:50		sends } same
"	12:52		"			e		22	Miller	12:51		sends } document
"	12:57		"		✓	do		23				recommendation for student body officer
"	1:03		"			dc		23				writes about student

FIGURE 2.3 SAMPLE SHADOW OBSERVATION RECORD FOR OAK BLUFF SCHOOL
(80% Original Size)

Documents

Like workers in other organizations, teachers handle large volumes of paperwork. Teachers received and sent messages from and to groups and individuals in various roles regarding academic, bureaucratic and personal topics. While many of these documentary communications were recurrent and formulaic, others were not. The recurrent documents included hall passes, parent verification of reading done at home, individual education plans for some students and requests for release time (to work on curriculum away from class). Other types of documents were unique. Some were lengthy (a psychiatrist's evaluation of a student), others brief (a flier announcing Success Period).

With the cooperation of the target team teachers, electronic mail of Oak Bluff was highly accessible during the fieldwork, for the teachers allowed us to read it over their shoulders. Consequently, our documentation of the content of email sent and received by the shadowing subjects is of high reliability. For more thorough analysis the email of team members sent and received was captured electronically (with permission of course). [3]

The Daily Research Routine

The observers carried out their shadowing activities independently, except for coordinating the schedule so that each teacher would be covered an equal number of days. Observers "bumped into each other" during the day when the people being shadowed interacted or passed each other in the hall. Each observer was at the mail area when the teacher "shadowee" arrived to begin the day by collecting his or her mail and proceeding to his or her classroom (or, occasionally, a coffee source, meeting, or colleague's room or office). Before leaving the building at the end of the previous schoolday, the researcher had talked to the target teacher to ascertain the time he or she planned to arrive in the morning. From the first moment on, the observer watched, listened and recorded all the shadowees' communicative behavior with other adults until he or she left the school in the late afternoon. Because our research explicitly addressed the collaborative aspects of teachers' work, we paid less attention to classroom instruction and its constituent activities. Interactions with students were noted but not documented on the shadow observation sheets.

When the teacher was not communicating with adults, but working individually (e.g., instructing a class, grading papers, writing lesson plans or counseling a student), the researcher continued to observe and record, but with less attention to the detailed nature of the task. This gave the researcher opportunity to polish the record on the preceding communicative behaviors, including qualitative notes as well as the structured observations. During these periods, the researcher also learned the types of responsibilities which comprise the profession and was able to see them as a whole. Once in a while, a teacher would turn to the researcher during a calm moment and explain the work and his or her feelings about it. Since we spent so

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3 In order to capture messages for this purpose, changes were made to the computer program which handled mail. For the purposes of collecting messages the teacher selected the recipient's (or recipients') starred (*) name(s) from a list in which each person's name appeared twice--once with an asterisk and once without; the starred recipient field sent one copy to the intended recipient and a second copy to a data collection file. This system allowed users to easily omit any message they did not want us to see; it also meant they could forget to save the message for us. The probability with which this occurred is impossible to assess, though shadowed subjects rarely forgot to use the starred entry. Consequently, the electronic mail messages we collected cannot be considered anything other than a non-random, non-systematic sample.

much time together, these conversations became substantive and personal, but never more than a few minutes long, due to the demands of the schedule. This routine, combining proximity to teachers for about nine hours a day for 60 days, a formal observation protocol and opportunities for spontaneous interviews, provided us a very close and informative encounter with the experiences of teachers and the conditions in which they work. Our research stance was a balance between the extremes of intense participation in the culture studied and detached observation. Wisecracks about the "hovering shadows" attested to participants' awareness of our presence. In contrast, the personal nature of some matters discussed in researchers' hearing suggested that participants either trusted their "shadows" or had forgotten we were there. We tried to balance personability with reserve, active data collection with a nonintrusive stance; the richness of the data suggests we succeeded. The tempo and pressure of the school day actually made it very unlikely that any teacher would pay undue attention to anyone. We participated by joining in chit-chat and some graver conversations, but we tried never to influence the direction or intensity of conversation.

CHAPTER 3
FIELD SETTING

In each of two middle schools, we studied the collaborative work of several members of a faculty team (six in Mountain View Middle School; five in Oak Bluff Middle School). This section describes the general characteristics and atmosphere of each school, the structure and purposes of faculty teamwork, the nature of the teams pinpointed in this study, and the communication technologies available.

Mountain View Middle School

The School

Mountain View is technically within the limits of a large city, but it has the look and feel of a suburb developed in the 1950's. Across the street from the middle school (the only one in the district) is the high school (also the only one). Nearby, a huge vegetable field, a major street and a cluster of apartments in the process of being built attest to the rural-suburban-urban transition the area is undergoing.

The building is based on a "modular" architectural design intended to facilitate flexibility in forming classes, but in 1973 walls for traditional classes were added. The wide spaces here--a broad parking lot, a huge entry-way, wide halls with high ceilings--seem not grand, but stark. The color beige predominates inside and out. Tile floors and steel lockers echo discordantly. Because the "baby boomers" were enrolled in its early years, the school is much larger than it needs to be now; primarily older folk without children inhabit the brick ranch-styles surrounding it. Today a large proportion of the school's students come from more distant areas where their parents work in factories and a rural neighborhood which buses its children in.

Mountain View houses only seventh and eighth graders--482 of them--and their 36 full-time teachers, two administrators, 12 teacher aides and three secretaries. Most of the students are white; they represent a wide range of social and economic backgrounds. A recent influx of workers from other regions of the country has contributed to a high mobility rate: about one third of the population is new each year. This mobility increases the number of students with special needs for academic, counseling and disciplinary support.

As in other schools housing early adolescents, the halls of Mountain View during passing periods (the time between classes, started and ended by a bell to signify that students should move from one classroom to another) are noisy; tension among the young people is almost palpable as they scrutinize each other, shout, and rough-house. A few teachers stand in the halls by their classroom doors, fielding wisecracks and troubleshooting. When passing period ends, a few teachers with "prep" (one period per day without a class, assigned to each teacher as planning time) hurry in the semi-darkness of the halls to the office for mail, production room for lessons aides have photocopied upon request or other teachers' rooms for hurried consultations. If a teacher needs to talk to someone who does not have prep at that time, he or she can peep through a small one-way window on the classroom door to see whether an interruption would disrupt the flow of instruction.

The conversations sandwiched in these sessions express deep concern for the individual students whose behavior causes the most problems for the faculty. Time and again the names of the same young people at risk of failure come up as teachers arrange "staffings" (special meetings on individual cases attended by all faculty who deal with them); decide what to require of them; strengthen their resolve to handle them firmly, patiently or however the cases require; and groan about the barriers these children put up to teacher and student success.

During lunch the scenery brightens; the faculty lunchroom is light and crowded (though the furniture is "functional" and decorations sparse). Around a large, round table a group of a dozen or so teachers play hearts. Others cluster around smaller tables and talk about school and personal matters. The resource room teacher, whose job (described in the section below) is extremely stressful, always plays cards expressly in order to break up her day. Others transact pressing business over their meal, for example learning how recalcitrant students are doing in others' classes.

The Neighborhood Teams

Increasing the depth of the hall and lunchroom conversations we heard were a number of recent innovations teachers were being required to implement. Foremost among these was a new social organization, part of ongoing "restructuring" in education parlance, dividing all teachers and students into four teams called "neighborhoods" named after streets. Two neighborhoods are comprised of seventh graders and their teachers; two, eighth graders and their teachers. Since each neighborhood is designed to be academically self-sufficient, its faculty includes teachers of the core subjects; faculty who do not teach only one particular grade (i.e., counselors and music, art, home economics and other teachers) are also assigned to neighborhoods. Team cooperation is enabled by a common prep period and a weekly Late Start Day (when students arrive an hour late) so that teachers can meet.

Each neighborhood's core classes--math, language arts (English), science, and social studies--are located in a designated section of the building. Its students are subdivided into classes of individuals who tend to remain together throughout the day as they travel from one teacher's class to another's. All the teachers, therefore, see groups comprised of most of the same individuals. Thus the neighborhood is a relatively stable community; most students interact with the same class members all day and stay in the same area near the other core classes of the same neighborhood. Light-hearted intramural competitions among neighborhoods are designed to create solidarity within them. From the teachers' viewpoint, the neighborhood faculty members all know the same children and have them in the same groups. One consequence: they all are familiar with the same group dynamics (e.g., individuals who "act out" when paired with certain others).

The district superintendent, who was inspired by recent experiments in restructuring schools, suggested the neighborhoods. The principal initiated their implementation in September of the year our research took place. In addition to creating a family-like atmosphere for students, the purpose of the teams was to structure teacher collaboration on handling at-risk students, planning student activities and working on cross-disciplinary curriculum. Each team had an otherwise unused classroom (available due to the population decrease) for its own use.

During our observations faculty spent a great deal of time on the few students with severe academic and behavioral difficulties. A second great time demand came from another innovation--an occasional "Success Period" in which students who had completed work were offered special activities (foosball and videos, for example) and less successful students were sent to classes where they needed help. (Success was the teachers' theme for the students that year; this entailed, among other strategies, instructing them in planning homework and recording their own grades.) The teams found very little time for developing curriculum.

The A Neighborhood Team

The research focused on six core members of one seventh grade neighborhood team (called the "A Neighborhood Team" or "A Team" here): one science, one math, one social studies and two language arts teachers (all of whom had classrooms in the same hall) and a resource room teacher (Figure 3.1). The resource room (in this school as well as many others including Oak Bluff, the second school in this study) was a classroom where students who needed remedial classes or assistance studying for their regular classes came for one or more periods every day. There were two resource teachers with degrees in special education who taught the classes there and supervised aides who assisted teachers and students. We took care to have one resource room teacher as a research target in order to capture the communication between her and the "regular" teachers about the students identified as facing special challenges. Such communication was essential to success of the at-risk students, and concern for at-risk students was central in team business.

The resource room teacher assigned to the team had some A Neighborhood Team students in her resource room as well as students from other neighborhoods. She needed to meet with any team which was conferring on one of her students, but since her formal assignment was to the A Neighborhood Team, she came to A Team meetings when not called to others. The other A Team members who were not research targets (but were at team meetings) were the librarian, industrial arts teacher, a counselor, a seventh grade physical education teacher and another special education teacher.

The team's room was on the same corridor as their classrooms. Architecturally it was one in a series of classrooms along their hall and did not serve a "centralizing" function. Full of tables, desks, other furniture and blackboards, it supported team meetings on Late Start mornings but was not often used for other purposes. When meetings occurred during prep period, they were usually held in classrooms. Various conceivable social arrangements which the room might have facilitated (pairs working on curriculum, say, or parties) did not occur. When not in scheduled meetings or informal conversations, teachers were instructing their classes, working on lessons alone in their own rooms, getting coffee near the production room, eating lunch or walking in the halls from one place to the next.

The research target team, with the exception of the resource room teacher, all worked in the same physical area with the same students. They met and interacted frequently (often rushing into each others' rooms between, and occasionally during, class periods). Just as individuals' teaching styles differed, so their styles for collaborating differed widely, no doubt a function of many factors. For example, the language arts teacher in his second year of teaching consulted with the "veteran" English teacher as he looked in her room for novels to assign. One female teacher often shared her concerns with the female teacher directly across the hall. Another

Mt. View Targeted Team Members

"A" Neighborhood Faculty Team

* Social Studies Teacher (Team Leader)
* Math Teacher
* Science Teacher
* Language Arts (English) Teacher
* Reading (English) Teacher
** Resource Room Teacher
Physical Education Teacher
Industrial Arts Teacher
Librarian
Special Education Teacher
Counselor

Figure 3.1 Research focused on the six starred (*) teachers in the "A" neighborhood team. There were three other neighborhood teams in the school ("B", "C", and "D"). The resource room teacher (**) was not assigned to Team "A", but attended its meetings when her students were the object of discussion.

chatted less and stayed in her room to work during most lunch periods. The team leader's communication was increased by chairing meetings and taking minutes in person to members' desks or to the mailboxes in the office where she ended up discussing business with others who happened to be there. Several teachers in the school pointed out that their intense interaction within teams, while useful and satisfying, led to less contact with other faculty, notably members of their own disciplines, than they would have liked.

The A Neighborhood Team's progress was affected by several critical activities during the period of our study. First, teachers were getting used to a new discipline policy with a clear sequence of disciplinary actions to be taken as a student's misdemeanors mounted. In the case of a student with chronic behavior problems, the team, in concert with the parents, wrote a contract defining the student's obligations and the school's responses if those obligations were not met. (A contract, might, for example, designate the number of tardies a student would be excused and the consequences for accruing tardies in excess of the limit.) Orchestrating contract creation was complex; moreover, the district could overturn a "ruling" based on a contract, increasing the complexity of negotiations.

A second activity was the district's introduction of Outcome-Based Education, an attempt to link curriculum, instruction and student outcomes. Most members of our target team took the district's two-day workshop on the topic during our fieldwork. Several voiced concern that the workshop required too much substitute time (setting their classes' education back) and that there were insufficient time and energy for implementation.

Third, the initial stage of a curriculum review (part of preparation for achieving approval from a state standardization committee) was underway. One social studies teacher dreaded the prospect of having to rewrite curriculum; the task would be to align all the social studies classes, so that students would cover all the required topics as they move through the grades. She had been involved on committees to do just that only a few years ago and had planned her own lessons accordingly. Now she feared she would have to start over again.

Beyond innovations, two additional factors are requisite context for understanding neighborhoods. One was committee work. The principal drew up a list of all the building and district committees to which any Mountain View personnel belonged: it was two pages long. (The district tended to have heavy committee workloads because, in spite of its small size, administrators tried to keep up on all education trends, thus laying multiple responsibilities on relatively few staff.) The other was that several teachers were planning to retire at the end of the year. Only one of these was a member of the team we studied. As a group, they were widely perceived to be only mildly interested in perfecting the neighborhood system during their last year of work.

Together, these activities and contextual factors contributed to some tension. Furthermore, the last few years had entailed similar pressures, and the teachers foresaw more in the next few years (reviewing, possibly rewriting, and implementing curriculum and addition of the sixth grade to the middle school). Contributing further to the high level of tension were issues involving district-building management. District administrators did not always give the principal a free hand to execute innovations in ways that made it easy for teachers, so there were knotty relations among the three status levels.

Communication Technologies

The communication technologies available to teachers in the school and the ways they applied them are described below:

Telephones:

Teachers, having no phones in their rooms, walked to the office, lunchroom or team room for calls. The resource room teacher had phone access in an office (next door to the resource classroom) which she shared with the other resource personnel. Faculty calls often were to a parent to report on a child's difficulties and learn context for making decisions. Occasionally there were personal calls, for example to an insurance agent after an auto accident and to the local cable TV company to subscribe to an upcoming basketball game.

Intercom:

The intercom console allowed office personnel to speak to any or all classrooms. From their own locations, teachers could speak to the office, but not to other classrooms. Most intercom messages were announcements from the principal or secretary reminding faculty about meetings, releasing class to the gym for assemblies or calling students to the office.

Photocopy Machine:

Teachers usually planned ahead and asked the two aides who worked in the production room to use the copy machine there to produce worksheets and other materials for students. Sometimes, though, they did their own last minute copying. Other times, they copied sheets for cutting and pasting as they designed originals. They also used the machine for faculty business items. One was a list of students to be disqualified ("d.q.'d") for recreational activities during the next Success Period. As adults bustled in and out of the production room, dropping off or picking up aides' work, it became a communication center. It was the only route to the coffee room (separate from the faculty lunchroom) where treats often were laid out and a refrigerator held sack lunches, so traffic was steady.

Chalkboard:

In the team meeting room, any classroom where a meeting was held and the library where full faculty meetings were held, the same chalkboards used for instruction became the place to post the agenda, the "brainstorming" suggestions and other ideas. Because of the extremely temporary nature of this medium, minutes might be expected to assume extra importance, but participants did not emphasize them. The meeting chair took minutes in the A Neighborhood Team. In resource room daily morning meetings, no one took notes. In spite of the crucial nature of many decisions, the number of urgent matters was so great and often the need to act so immediate, that written records were not part of the process.

Overhead Projector:

Relative to a chalkboard, an overhead projector had the benefit, for instructional purposes, of allowing the teacher to prepare or borrow some material ahead of time and face the audience. It's also easier to read and leaves no chalkdust. The same advantages might accrue to its use in meetings, but we did not attend any meetings where it was used.

Personal Computers:

The principal and vice principal had computers terminals in their offices and were linked to administrators in their education service district (a unit encompassing several school districts). The computer classroom, with about 20 computers, was often free of students, but teachers did not tend to use these machines. There were also several computers in the resource room which allowed rudimentary word processing, and the resource room teacher used these machines on occasion for that purpose. Though she saw the potential for a personal computer to assist her with the volumes of records resource teachers are required to maintain, the basic machines in the resource room classroom were not capable of handling that task. A personal computer was available in the production room, but in practice most teachers submitted requests for typing to the production room aides rather than type themselves. One language arts teacher on the A Team had a personal computer in her room during part of the study and used it with pleasure. For instance, she wrote pages of notes to prepare her substitute for her own upcoming two-day absence. The other A teachers had no PCs at school.

Printers:

There were printers to go with computers in the main office, production room, computer classroom, resource classroom and the classroom of one of the A Team language arts teachers.

Typewriters:

Most classrooms did not have typewriters, but several were available in offices and other rooms, including the resource teachers' office. Few teachers used these machines.

Calendars:

Most classroom walls displayed large calendars. Teachers' lesson plan books served for scheduling instruction. In our observation, they did not use pocket-sized personal calenders. The A Team used a large calendar in the team room to keep track of special events which involved the team or neighborhood.

Human Communication Mediators:

The school's internal mail system depended on a student circulating at least once each period to pick up attendance information from each class. It also depended on teachers walking down the long halls to the office to send and receive mail since no classes were next to the office. Teachers tended to stop at the office on their way in and out of the building to check their mailboxes.

Students played a double role as mediators and subjects of communication when they carried hall passes informing any adult who might wonder why they were out of class that their presence in the hall was legitimate.

Posted Documents:

Gathering places (faculty lunchroom, production room, counselor's office, central office, the mail area, and others) had bulletin boards. These carried notices from the district, union, administrators and faculty concerning everything from retirement party announcements to federal minimum wage notices.

Almost any surface could become a medium for carrying a message. A district job opening was taped to the window on the mailroom door. The science teacher's classroom wall displayed her list of students disqualified for Success Period leisure activities so that other A Team teachers could read it. But such postings were not the norm; it was more common to receive announcements for the whole faculty in one's mailbox and announcements for the A Team by word of mouth in the A Team. There were few postings for the A Team in their team room.

Bells and Clocks:

Every classroom and almost every other room in the building had a large, round clock. Bells were set to go off at the beginning and end of every class and lunch period. On many days, class periods were 45 minutes, but there were alternate schedules with shorter classes to make time for advisory class (a weekly class filling some of the functions of a traditional homeroom with an added emphasis on creating a family-like atmosphere for students), a Late Start Day (for teacher teams to meet), Success Period and assemblies.

Oak Bluff Middle School

The School

Oak Bluff, on a tree-lined street overlooking a river park and adjacent wetlands (great for science fieldtrips), is in a suburb 20 miles from a large city. Once an independent small town noted for its charm and historical sites, its population ranged across several income levels. Now, in the wake of metropolitan growth, it also has the traits of a bedroom community with many new, expensive houses. Many residents work at well-paying, professional jobs in suburbs or city. Generally, this new clientele expect education to prepare their children for success in college and beyond.

The school district has three middle schools; a few years ago Oak Bluff had the reputation of having the "roughest" students and least inspiring program. At that time a new principal resolved to make improvements by addressing one realm of challenges each year (discipline policy being the first realm to be "cleaned up"). By the research year, no single problem took precedence, so committees were formed for working on a variety of issues (including student awards and faculty health).

During the year prior to our research, the school district decided to build a new middle school to house the current and future students and staff of Oak Bluff. Originally an elementary school, the existing building would revert to its old purpose and contain elementary students once the new middle school was completed.

A networked personal computing system had been installed at the beginning of the previous school year. Extremely unusual in a public school, the system existed because the principal requested it from a schoolboard which, priding itself on promotion of advanced technology and wanting to boost morale at this particular school, found the funds to grant it. Comprised of Macintosh computers, the Oak Bluff network included electronic mail (email) and file sharing capabilities.

Upon entering the building, a visitor faces a display case with cheerful art and messages which are changed frequently to fit the season. To the left side is the office, to the right a hallway lit by ample windows. The halls and rooms are carpeted, so clatter is softened. Past the office to the left is a corridor with classrooms. To the right are two more corridors in a double-storied wing of the building. Though an older building, new carpet and fresh paint (pastel blue) gave the school a clear and bright feeling. Recent construction of a new wing provided modern and spacious laboratories for science classes. Because of overcrowding, a large "portable" (converted mobile home) houses additional classes. Student art lines the walls: patriotic posters, literal depictions of figurative expressions (e.g., "cutting the cheese") and more. During our fieldwork, construction noise hammered away the otherwise calm environment; the gym had burnt down over the summer (arson was suspected) and was being replaced.

Sixth, seventh, and eighth grades comprise this school of 370 students and 31 teachers (not all full-time) with two administrators, eight aides, and two secretaries. Most of the students are white and middle or upper middle class. The social problems which surface during teachers' work with them include drug abuse, delinquency and family tensions.

Teachers in Oak Bluff have a very professional image. Dressed either in clothes smart enough for job interviews, or more casual, but equally impeccable, attire, they dash through the halls on between-class errands. The administrators enhance this image by listening to staff concerns about their jobs and trying to involve them in determining policies. As in our first school (and countless others), they compress information, jokes and serious decision-making into a few minutes in the hall, office and next-door mailroom. Near the mailboxes are a phone, photocopy machine, bulletin board and supply room; the mailroom is a hub of activity, accommodating business and personal contact with the world outside the school, curriculum development, district news on fliers and other kinds of communication.

Although less radical in its restructuring than Mountain View, Oak Bluff was also trying to restructure teachers' social organization for collaboration. In fact, the principal took as the theme for the year an inspirational passage about the coordination of a flock of geese in flight. Each teacher was a member of a subject area team, an issue committee and a grade-level team. The Teachers' Leadership Committee (T.L.C.) was a cadre of eight teachers and administrators who met regularly to discuss a wide variety of plans and issues such as peer coaching and an action research project involving faculty. The faculty as a whole also met regularly.

The Seventh Grade Team

We focused on the seventh grade team. Officially, its members included the teachers of seventh graders and certain faculty who did not specialize by grade but were assigned to it. Since all of these individuals were on the seventh grade team computer list, when electronic mail was the channel chosen for their communications, they all could participate and many did. But when meetings were held, only the teachers of seventh grade classes came and thus formed the unofficial seventh grade team. We targeted five key members: the math/computer teacher, science teacher, two language arts teachers and the resource room teacher (Figure 3.2). The math teacher was assigned to the seventh grade team even though her students were from all three grades (due to an emphasis on skill rather than grade in assigning students to math classes). She doubled as computer support person for faculty. This often entailed receiving an email message from a faculty person requesting assistance, hurrying during the next moment free of students to the requestor's room, explaining the solution and returning to her own room. The computer support teacher also provided one-on-one training on the use of an attendance database, a grading program, email and, in some cases, programs for developing curriculum. (The curriculum programs were the least used.) To make time for this extra duty she carried a reduced teaching load. The resource room teacher's job was similar to that of the resource room teacher in Mountain View, except that she had one room which served as both classroom and office, no additional resource room teacher and only two aides. She was not officially a member of the seventh grade team, but she had many seventh grade students and interacted with their teachers regarding their progress. We included her as one of our research targets because we wanted to capture this interaction as we did with the resource room teacher in Mountain View. Our research target team could not include the sixth significant seventh grade team member, the social studies teacher, because he declined to participate in the study.

The purpose of the team was to coordinate seventh grade instructional and special activities and develop cross-disciplinary curriculum. Its main cross-disciplinary pursuit for the year was related to Earth Day and highlighted tree planting, study of wetlands, and a simulation of an "Ecotastrophe." These classroom activities involved the science and two language arts teachers and their students.

Communication Technologies

The various ways Oak Bluff personnel employed communication technologies are described below.

Personal Computers:

> Each full-time teacher and administrator had an Apple MacIntosh computer for his or her own school use. There was an extra computer in the workroom just off the faculty lunchroom for use by part-time faculty. Each teacher found an idiosyncratic way to place it in the classroom. Most put it on one side of the main desk or close enough that it was unnecessary to change chairs when switching from pencil and paper to keyboard and screen. A few kept it on the opposite end of the room from the teacher's desk. One kept hers across the room behind a large potted tree and covered its table with a colorful, textured scarf.

Oak Bluff Targeted Team Members

7th Grade Faculty Team

* Math/Computer Teacher
* Science Teacher
* Language Arts and Literature (English) Teacher
* Language Arts, Literature, and Reading (English) Teacher
** Resource Room Teacher

Physical Education Teacher

Math Teacher

Music Teacher

Counselor

Figure 3.2 Research focused on the five starred (*) teachers in the seventh grade team. There were two other grade level teams (sixth and eighth). The resource room teacher (**) was not on the team, but interacted with its members regarding students she had in common with them.

All teachers were required to use their PCs for reporting daily attendance and term grades to the office. Although they were not required to compute these grades with the program provided, most or all of them did so. Interestingly, though the network enabled file transfers, teachers had not yet mastered that process and so carried diskettes containing grades to the office where the secretary processed the files on her computer. Enough school communication was channeled over the network that it was necessary for those who wanted to be informed to remain logged-in. Teachers could also call up the daily school news bulletin on the screen or pick up a hard copy in the mailroom; some preferred to have a student read it aloud to the class during the opening moments of the first period while they were using the computer for doing attendance and reading the morning's email. Electronic mail documents ranged from perfunctory memos from the vice principal reminding people of a district meeting of secondary importance, to chains of memos for finalizing decisions, to lengthy emotional memos about the rudeness of one student's parents.

Attitudes toward the computers were positive: we heard many teachers say words to the effect of "What did we ever do without it?" Several owned or were looking into buying similar computers for their homes. In terms of the interface between work at school and home, the technology introduced a complexity: in order to work on grading at home (almost a necessity because the days were full of students, meetings, and classes) teachers needed to keep a traditional grade book in addition to their computerized grade records. Computer styles and competencies varied. One older teacher frequently sought help from a younger teacher and the two even devoted some Saturdays to up-grading her skills. The vice principal "loved" her machine and used it to send messages off and on all day long. Yet her flurries of computer "talk" did not seem to decrease her face-to-face interaction, for she also walked the halls and "popped into classes."

Part-time teachers did not have their own computers but could use the ones in the classroom they "borrowed" from full-time faculty or the one in a room off the faculty lunchroom. There also was a computer on each of two secretaries' desks. People used each others' computers; the resulting electronic mail carried the name of the computer "owner". One resource room aide used the resource room teacher's computer occasionally; the other aide did not. The language arts teacher's aide sat on the other side of the room and did not borrow her computer.

Intercom:

> There was no intercom system. The computer network was used for all types of communication normally conducted through an intercom.

Photocopy Machine:

> The copy machine in the mailroom increased both informal and professional interaction in that location. Another copy machine stood in the audio-visual media room, a step away from a door into the math/computer teacher's room. Teachers copied their own lesson materials in this school; there was no production room. On first glance this may seem like an unprofessional chore for a teacher, but on close observation we learned that teachers did not copy a lot because they were not assigning many worksheets. Perhaps the email network also reduced their copying; if someone had a message to send to a list, no multiple hard copies were needed.

Chalkboard:

The seventh grade team met in a classroom with a chalkboard but did not use it; there was no written agenda (unless on personal notes). The full faculty meeting was held in the library with no chalkboard; the written agenda was passed out on paper. The vice principal once used the chalkboard in the office when the T.L.C. met; she drew a diagram of committees and their interrelationships as they tried to depict them. It stayed on her board for many days; apparently no more pressing use displaced it.

Overhead Projectors:

Available in classrooms and library, and used for instruction almost daily by most teachers, this technology was not often used for meetings.

Printer:

There were a laser printer in the main office and a dot matrix printer in a supply closet near some classrooms. Most teachers used the former, more centrally located, machine. When the resource room teacher printed letters (a common task for her) she phoned her aide back in the classroom to push the print command at the right moment (after she had inserted letterhead paper into the paper tray in the laster printer).

Typewriters:

The secretaries', media specialist's and a few teachers' desks had typewriters. These tended to be used for typing purchase orders and other accounting activities. We never observed teachers using typewriters.

Calendars:

Teachers referred to wall calendars and lesson plan books in their classrooms more than personal calendars. The school bulletin was an important "scheduler" and reminder of some faculty events.

Human Communication Mediators:

Because of the electronic communication, the school did not send a student to collect attendance data each period. (The year following our study, however, saw the reintroduction of the human mediated attendance data collection. The teachers easily forgot to send their information over the computer; as a reminder, they found the presence of a student waiting at the door more powerful than an email memo from the attendance secretary.)

Posted Documents:

A bulletin board by the side of the mailboxes displayed district news. Although it was out of obvious view, we often saw teachers read it. A second bulletin board in the faculty lunchroom carried less "official" information

(e.g., the staff birthday list and the blue prints for the new middle school). Other notices and announcements, some informal and others official, were taped to walls, mailboxes and doors.

Contrast Between Target Teams in Mountain View and Oak Bluff

The two schools differ in size, population type and ethos (Figure 3.3). Mountain View is larger, includes a higher proportion of at-risk students and was undergoing several changes which created stress. Oak Bluff (although it has one more grade) is relatively small, probably contains a lower proportion of students who face severe academic and social challenges and was experiencing less pressure to make radical changes.

Very significant for the research were the differences between the team structures at the two sites. In the first case, the neighborhood teams were the primary means of organizing teachers, and the research target team included significant members of one such team. The other members of the same team were involved in meetings, but in the grind of orchestrating core subjects, Success Periods and movement through the hallways, they did not interact with the research target team intensively. In the second case, the grade-level teams were one of several means of organizing teachers; again the research target team included key members. The peripheral seventh grade team members participated in email discussions of seventh grade issues but were not even considered members for meetings and projects with seventh grade classes.

A further difference between the two sites was in the roles researched. Our research encompassed the activities of six team members in Mountain View, but only five in Oak Bluff (because one, the social studies teacher, declined to participate). The high level of interpersonal contact of the math teacher who supported faculty in their needs for computer assistance could not be paralleled, of course, in the school without a computer network. In short, the two teams and their members' job assignments were roughly but not precisely parallel. In no two middle schools would one find identical structure and roles. Given the considerable commonalties between the two schools, our research is able to highlight collaboration in two contexts selected for the following differences: in Mountain View, the endeavor to restructure social organization for collaboration (neighborhoods) and, in Oak Bluff, the endeavors to employ a new communication technology and emphasize teamwork. The computers and local area network added a new dimension to the issue of communication and collaboration among teachers in Oak Bluff. As we will see later, the contrasts between the two schools were significant in some ways and less so in others.

Research Target Team	Workgroup	Work Assignments	Location of team members classrooms	Physical Space	Channels in Classrooms	History/ Context	Workgroup Homogeneity/ Composition	Span of Responsibility
MOUNTAIN VIEW Six 7th grade teachers	Neighborhood team (one half of 7th grade faculty in school)	individual assignments: resource room, language arts, science, math, social studies. All members except resource room teacher have the same groups of students and prep period team duties: curriculum and staffings on individual students	proximate core group; resource room teacher in another hall	one classroom/ teacher team meeting room lunchroom shared with all faculty	no phones except in resource room; intercom student messenger no personal computers	innovation this year: neighborhood team assembled for middle school restructuring 482 students in 7th and 8th grades 36 teachers	team leader assignment of resource room teacher differs from classroom teachers' assignments one retiring teacher	individuals responsible to leader and other team members team responsible to administration
OAK BLUFF Five 7th grade teachers	7th grade team (all 7th grade teachers and other assigned faculty, e.g. counselor)	individual assignments: resource room, language arts, science, math and computers. Members do not teach the same groups of students. Three have the same prep period. team duties: curriculum and staffings on individual students	dispersed on one floor	one classroom/ teacher no team meeting room lunchroom shared with all faculty	no phones except in resource room and math and computer teacher's room no intercom student messenger networked personal computers with email	traditional grouping: all 7th grade teachers and faculty assigned to 7th grade team networked personal computers (with email) in 2nd year of use 370 students in 6th, 7th and 8th grades 31 teachers	no team leader assignment of resource room teacher differs from classroom teachers' assignments one retiring teacher	individuals responsible to other team members team responsible to administration

FIGURE 3.3 TARGET TEAMS' WORKPLACE CONTEXTS

CHAPTER 4
RESULTS

The Nature of Teachers' Work

On the shadow observation record we named and counted many communicative tasks the teachers performed each day. These were the pursuits they told us they were working on or we learned by experience to identify, e.g., writing a message to a certain person, discussing class placement of an at-risk student, reading a letter from an administrator and many others. In performing these tasks, teachers fulfilled two major responsibilities: *instructional work* and *social work*. As we describe these responsibilities, it is clear that, although each may entail more than one task, they are distinct concerns which teachers recognize and are obligated to address. We shall term these responsibilities *Job 1* and *Job 2*.

Job 1: Instructional Work

Teachers were hired to teach students academic content and perform directly related activities. They did this in three ways. First, they led classes. This entailed teaching academic content--presentations, projects assignments, etc.--and managing classroom behavior--organizing the class (sometimes into subgroups) and preventing or handling disruptions. Secondly, they planned curriculum by planning content--academic material and concepts--and planning student behavior--groups, movements and tasks. Finally, they were responsible for evaluating student learning by formally and informally assessing, grading, recording and communicating grades.

Most people think of the job of teaching as standing in front of a group of seated students and lecturing or supervising. For seven class periods in our first school and eight in our second, teachers did spend about fifty minutes instructing their classes, but the organization of students for these activities was more diverse than the popular image suggests. Teachers held conferences with individuals; taught small groups while other students worked in the classroom, computer room or library; showed films; listened to student reports; read orally; circulated around the room to help individuals while others worked at their desks; administered tests; supervised laboratory work and art projects; and taught in other ways. Occasionally, while a class was busy, teachers performed social work as discussed below. Academic instruction in the classroom went hand-in-hand with student behavior management. For example, Anne Harris, the language arts teacher at Mountain View Middle School, told her students to form small groups, each one to discuss a different novel about the World War II Holocaust. Since the students had previously been taught the small group discussion process, there was no need for disciplinary comments from the teacher.

Behind each instructional scene lay planning: learning about (and, for some, the committee work of helping to create) state, district and building curriculum requirements and guidelines; selecting books; writing lesson plans; collecting materials and equipment; and studying the topic. Part of the planning by English teachers in Oak Bluff Middle School had been to agree to have their students read certain literature in each grade. In one unusual planning episode, they considered a vehement complaint about the novel A Wrinkle in Time by Madeleine L'Engle from a parent who believed it expressed values at odds with Christianity. They decided to send the parent a letter explaining honestly that they had dropped the book from

the curriculum but not for the reasons she had raised. More routine planning included activities like revising a printed test on Africa to reflect the information covered in class, reading the textbook and writing assignments on the board or overhead projector prior to the arrival of students in the classroom. For a resource room teacher, planning often meant talking or exchanging written messages about resource room students' work in "regular" classes, i.e., assignments, progress and needs for assistance. Student evaluation was a significant part of planning. The eleven teachers whom we studied graded papers and wrote progress reports (in the middle of each term) and term grades for each student. We did not observe teachers at home; many evenings they took home briefcases, cardboard boxes, grocery sacks, or designer carry-alls full of papers to grade, curricula to write, and other work.

Job 2: Social Work

Teachers also work with students on a non-instructional basis. They naturally must interact with children while transmitting academic content to them and implicit social learning is transmitted with the content. But beyond that, teaching in the middle schools studied, as in U.S. public education in general, required diverse kinds of attention to young people inside and outside of class time.

Every teacher assumes "casework" on individual students identified as needing special attention. This involved conferring with students and parents, consulting specialists and other teachers and reading records of past behavior. Information exchange and counseling could be oriented toward crises at home or in the community or more regular events such as assignments due. In each of these areas, there is an enormous and increasing amount of paper work required by the district, state or federal authorities.

Nearly everyday teachers are responsible for various "duties" monitoring student behavior in halls, cafeteria and outdoor locations. Some of these tasks rotated according to a schedule which usually was fixed at the beginning of the school year. Duty assignments varied in flexibility by school and teacher: some duties were observed rigidly, others could be usurped by more pressing business. For example, a teacher who was expected to stand in the hall by her classroom door was able to dash to the office for her mail. Duties also varied in the extent to which the responsible faculty member could transact other work while carrying them out. For example, Valerie Riley, the Oak Bluff computer teacher and teachers' computer support person, was very busy with teachers as well as students before school. So, one day during her assignment to morning bus duty, she stayed in her classroom until she heard of a problem with students at the bus-stop and then hurried out to take care of it. Although duties took up a small proportion of time, they are significant because of their flexibility.

Informal interaction with students is a part of every teacher's day. It would be impossible to talk with students only about course content, only during class periods. Of course the extent, purposes, and functions of the socializing and nurturing between and during classes vary. In addition, teachers are constantly involved in special activities not designed directly to enhance the curriculum. Included in this category are such activities as celebrations of the last day of school, sports supervision and a breakfast for "Secret Pals." Excluded are fieldtrips related to course content (which are considered academic work).

Organizational Activities Supporting Both Jobs

The two responsibilities described above focus directly on the services teachers provide students--academic instruction and support services related to their social and emotional well being. From one perspective, these activities comprise the teacher's job. To the great frustration of most teachers, however, this classification is incomplete. An enormous amount of time and energy is consumed by activities which are only indirectly involved with students. Out of view of the public--visitors, students and parents--teachers are involved in a swelling mix of bureaucratic activities required for the day-to-day delivery of academic and social services. As in many jobs, volumes of paper work are required to administer various activities and programs. For example, teachers must routinely process documentation about ongoing student progress reports, disciplinary action, and "due process." In addition, teachers are required to serve on myriad committees dealing with everything from faculty wellness to action research projects. As participants in such committees, teachers keep minutes, collect and synthesize information, and write and review reports and position papers. Teachers also meet to write, revise and coordinate curricula; choose books and materials; debate a point or defend a decision before the school board; maintain working relationships among faculty; assist student teachers; sift and sort through mountains of catalogs, newsletters and notices; and take college courses to maintain their teaching credentials.

Although teaching probably was never as simple as most lay persons believe, it clearly is becoming an ever more complex mix of activities and tasks. In addition, the proportions of instructional and social work in that mix is shifting in significant ways. Teachers are spending increasing amounts of time and energy attending to the social needs of their students. At the same time, they are being held accountable for more and more organizational responsibilities. Instructional work (which most of us--teachers too--envision as the most important responsibility) is changing dramatically as teachers take more responsibility for creating curriculum and cross-disciplinary instruction and emphasize processes such as critical thinking, problem solving and teamwork. In providing complex and interdependent social and intellectual guidance, they are increasingly involved in collaborative planning. All of these changes are tied together in such a way that the role, environment and responsibility of the teacher has been fundamentally and irreversibly changed.

The Structure of Teamwork and Communication

By design, this project highlights the collaborative work of teachers: the tasks they worked collaboratively on with members of their own teams or with other adults. Through this focus, we hope to learn more about the ways people, locations, school time and communication channels facilitate and limit teacher collaboration.

Because we focused on these collaborative activities, we classed work which teachers accomplish individually as non-collaborative work. This residual category includes most of the work which the public usually associates with the job of teaching--group instruction, help for individual students, correction and evaluation of papers, creation of courses, worksheets and art projects--in short, all the work directly with students or materials by or for them. Non-teaching activity, the tasks and activities carefully delineated in this study, include all those on which teachers collaborated to further the intellectual and social development of the children and to keep the institution running. Although intellectual, social or organizational

purpose dominated some tasks, most combined more than one purpose. Figure 4.1 illustrates the proportions of teaching and non-teaching work. At each school teachers spent roughly one third of their time on non-teaching activities; these are the activities analyzed in the remainder of this chapter.

What Collaborative Tasks Did Teachers Do?

This section focuses on the constellation of activities which comprise the teachers' day. The basic unit of analysis is a task which includes any item of business a teacher pursued, for example, arranging a team meeting, tracking a certain student, taking attendance, deciding which textbook to use, discussing a student body election.

Routine items stood out. These were the daily or weekly tasks necessary to organize kids in order to attend to their social and academic needs. Every day a teacher read a school bulletin and took attendance. Almost every day a teacher dealt with hall passes about late students or those who needed to leave class early and distributed overdue notices from the library, detention slips and printed schedule changes for the day. At Oak Bluff, email exchanges with the attendance secretary and teachers regarding the whereabouts of individual students were common. Although these brief communications, often on forms, were related to student behavior, they informed staff about that behavior and were essential to running the school.

Faculty organized and attended special events. These were more common at Oak Bluff. For the students, teachers arranged an All Species Dance (in which students wore animal costumes to celebrate awareness of environmental issues), a Milk Jug Contest (to promote recycling), a Secret Pal Breakfast, a fieldtrip to plant trees, a Faculty Follies performance by teachers and an excursion to celebrate the end of the schoolyear. The last event entailed determining feasible sites, arranging a student election to choose a site, making travel and financial plans, assigning supervisors and listing eligible students. Occasionally, faculty arranged events for themselves, such as the Mexican Potluck for all faculty and staff and the more informal events such as get-togethers for two at a tavern or for several in a teacher's hot tub.

A demanding task was to monitor the progress of students who needed extra attention for academic or social reasons. In both schools this often involved the resource room teacher because she had many of these students in her classes. Her job included getting other teachers' lists of assignments on which students could work in the resource room; sending aides to help students in their regular classrooms; listening to the aides describe students' performance in regular classrooms; arranging meetings with parents and teachers to make decisions about their education; and taking letters from psychiatrists to appropriate faculty. There were frequent informal discussions of a few of these students' work, their problems, their family situations, and how to address them.

Much of the resource room teachers' communication was with adults outside the school, including families and personnel from other schools which her students had attended. Some communication was formal. For example, forms were used as

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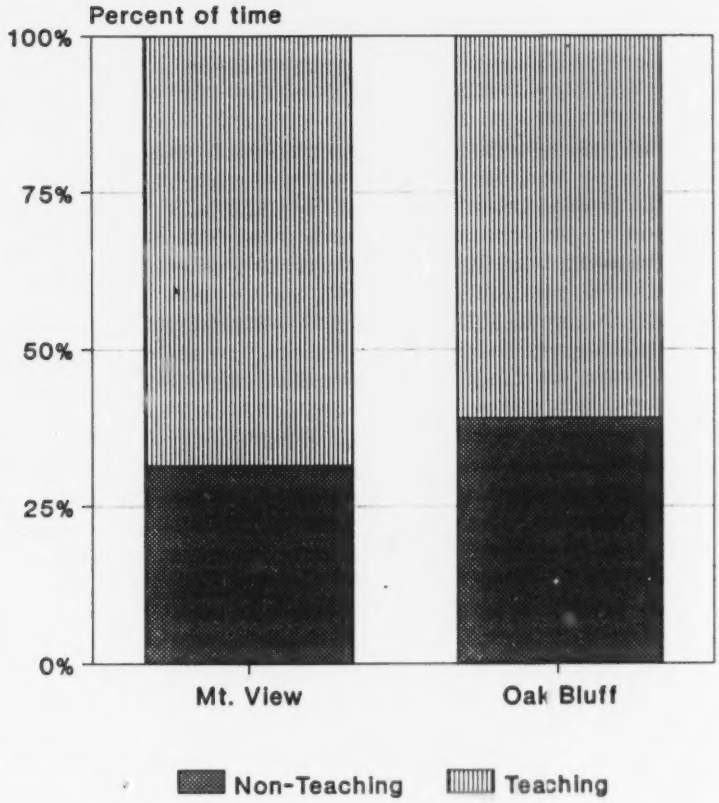
4 Each time a figure is presented in the text, corresponding numerical quantities are tabled (with a number corresponding to the figure) in Appendix B, e.g., Table 4.1 in Appendix B lists actual minutes and percentage of time for both schools.

Figure 4.1
Teachers' Activities



required by law when identifying students as learning disabled. Much communication was less routine, however. When a girl with a history of mental illness did not come home after school, several faculty and two staff members did detective work with students and parents until they were assured that she was alright. In a meeting for a girl who had been learning well in the resource room all year, the resource room teacher, one of her other teachers, the girl and her mother planned her schedule for the next year to ease her transition into regular classes. The A Neighborhood Team teachers worked together day in and day out on these cases because they shared the same students; administrators and counselors often joined such teams when they held formal meetings. In one meeting, called a "comprehensive case analysis" of a student, a counselor stood at the chalkboard and jotted down the information team members contributed under headings about the student's schoolwork, family life, relations with peers and history. In another meeting, teachers showed a mother and father a behavior contract the principal had written with their child and asked them to sign it.

Some tasks were related to using computers. At Oak Bluff, the math and computer teacher who was assigned to troubleshoot faculty computer problems worked especially hard on these. She usually started out her day receiving mailed computer advertisements; often rushed to a teacher's room to demonstrate a computer command; and kept people up-to-date on new programs on the market. As computer teacher, she scheduled times for classes to use her room. (Even when a group came to work "independently" during her prep period, she ended up helping them.) Other teachers collaborated on computer work, too, helping each other develop skills. At Mountain View, one of the English teachers had a personal computer in her room for several days and used it to write extensive notes to the substitute, who took her place while she attended a workshop on Outcome-Based Education. She told us that she wanted a computer in her room permanently and that at one time she and all the English teachers had expected to have computers but never received them.

The diversity of subjects requiring adult interaction seemed to be without limit. Some of these tasks were literally momentary, as when a teacher confirmed the availability of the video recorder or found out who had walked off with her stapler. Others were intense and took lots of time, as when several teachers and faculty conducted job interviews. People showed each other how to do things, e.g., laminate; collected funds for gifts; responded to a union survey; told others there were phone calls for them; learned about district, union, and other meetings; and performed many other chores related to organizing and delivering education. At Oak Bluff, we observed teachers planning curriculum, collecting textbooks and charging students for lost texts, showing each other microscopic views of pond water and deciding which students to award. People discussed and planned their responses to students' behavior outside of class--noise in the halls and eating in the classroom, for example. They deliberated over how to handle a mother who came after school many days to monitor her son's detentions and late work. At Mountain View, we saw a teacher read instructions for scoring a math contest and then ask the school's art teacher to write in calligraphy certificates for the winners. Another teacher read a brochure about a workshop on collaboration. A teacher received from the principal a pre-conference form, taught a class while he observed, discussed her work in a conference with him and scheduled a post-conference follow-up. Team members told the science teacher how much they liked her students' Earth Day posters which she had displayed along the A Neighborhood hall.

The average number of non-teaching tasks teachers in each school worked on each day are depicted in Figure 4.2. The number of tasks in both sites was very high: approximately 37 in Mountain View and 44 in Oak Bluff. The difference between them is not great but might reflect the reliance on teams to structure intensive work on fewer tasks (especially Success Period and at-risk cases) at Mountain View and the electronic network for collaboration at Oak Bluff.

What Kinds of Places Did Teachers Use for Doing Non-teaching Work?

The main areas for work and communication were classrooms, halls, the main office/mail complex and the faculty lunchroom. During most of the time in which teachers were working on non-teaching tasks in their classrooms, they were alone at their desks or talking to one or two other teachers.

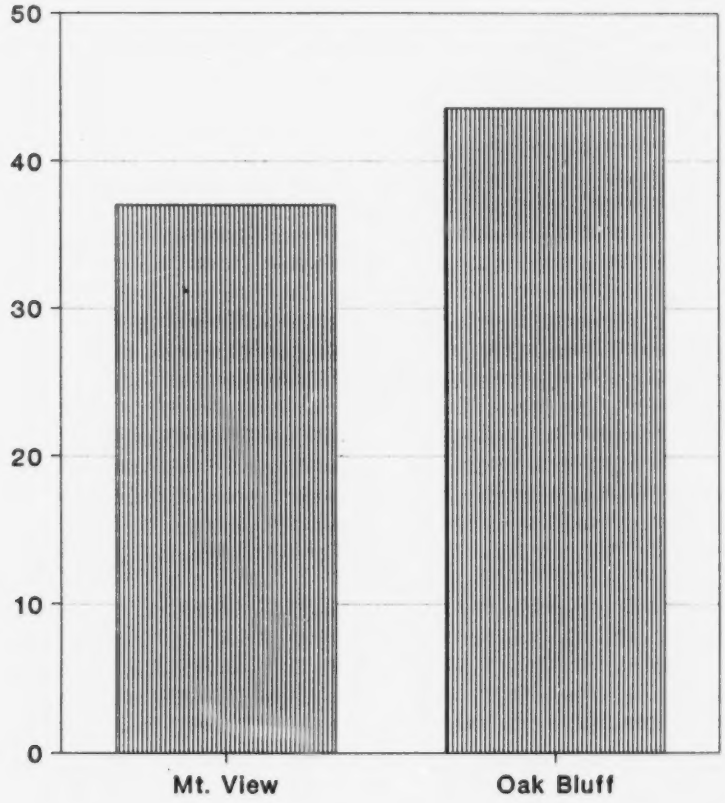
Although classrooms did not offer the privacy, equipment and proximity to secretaries that offices provide for other types of professionals, they did make fairly good meeting rooms because of their size and seats (on the small side but usable), chalkboards and other equipment. In Mountain View, the A Neighborhood Team had a former classroom assigned solely for their use as a team meeting room. Unused classroom furniture was pushed into the corner to make room for a huge table formed by pushing large tables together. There were no decorations. Team faculty did not always drop by the room (even though it was located on their hall) to chat or work, often holding meetings in one of their classrooms instead. In Oak Bluff there was no room reserved for the seventh grade team; they met in a classroom.

The halls were a conduit for communication as people passed each other going from one place to another. The hall in Mountain View took on a distinct character because those who ran into each other were apt to be of the same team; all the Oak Bluff team members were widely scattered on one floor of the two-story building, so they were as likely to see members of other teams as their own.

Faculty lunchrooms were one of the few places students could not go. Although teachers took lunch and other breaks there for informality, fun and food, a substantial portion of the conversations were about school politics, curriculum and individual students' welfare. These topics often faded into personal interests such as weddings, dog races and vacations. Controversial topics (like religion and national politics) and deeply personal matters did not surface. This may have been because there was no privacy; the round tables were not separated by partitions, so people could hear others around the room. Ringing the room were old couches and easy chairs from which people chimed in on the talk of those at the round tables.

An additional break room was provided at Mountain View. This was a small room adjacent to the production room with photocopy machines, computers, paper cutter and other equipment where teachers' aides produced instructional materials upon teachers' requests. The small room offered a coffee pot, table for donuts and newspaper and refrigerator for sack lunches. A second source of coffee, farther from team classrooms, was the kitchen between the cafeteria and faculty lunchroom. At Oak Bluff, aides did not specialize in production, so there was no production room to serve as a break room. There also was no coffee in the kitchen, but the vice principal kept a pot brewing in her office.

Figure 4.2
Average Tasks Per Day



A central area of communication in each school was "the office." This consisted of a central office area where the school secretary and attendance secretary worked, a mail area with a box for each teacher and a photocopy machine. The principal and vice principal had offices leading off from the central office area. The counselors at Mountain View had a separate office complex across the hall; the counselor at Oak Bluff had his office in the main office complex. People came to the complex to send and pick up mail, make photocopies and do business with administrators, secretaries, parents and other outsiders (who were usually expected to come to the office before going elsewhere in the building). Teachers usually conducted more business in the office than intended, because of interactions with others coming in and out on similar errands.

Locations team members visited outside the school were few. In each school, we observed one group of teachers leave the campus for a lunch; in both instances they perceived it as a special occasion and joked about it as though they felt guilty. One teacher left school briefly during one lunch to visit his elderly father. Another left for her lunch break and prep to do personal business; she and her confidants refrained from mentioning this to others. The resource room teachers left to go to meetings pertaining to students graduating to or from the middle school in order to plan services for them at their new schools.

There were no private places for teachers in the schools. The classroom was considered the teacher's own personal sphere for instruction and paper work but students and teachers could enter without knocking, regardless of the time period. Other spaces--halls, faculty lunchroom, and office--"belonged" to all the teachers and were quite noticeably public. These places varied along a continuum from formality to informality. For example, the staff lunchroom elicited the least formal behavior--people sometimes put their feet up and occasionally told off-color jokes. But formality and informality alike afforded no privacy; the demeanor a location demanded always was a public demeanor.

When in their classrooms, teachers were long distances from one another. Because there were many classrooms and they were bigger than offices in most other types of institutions, teachers were not densely dispersed within the building. Long halls meant walking, and that took time. When it took a teacher a minute to go from his or her classroom to the mailroom (at a fast clip) and a minute to open the door, grab the mail, and get out, only three minutes of a five-minute passing period were left. If the same teacher needed to use the restroom (far from the mailroom in both schools), some other goal of the journey had to be cut. The distances not only kept people apart, in some ways they supported communication as well: as mentioned above, the long halls served as "conduits" in which people conversed and hailed each other along their way.

Figure 4.3 presents the percentage of communication episodes (see Chapter 2 for definition of episodes) which occurred in the shadowed teacher's own classroom; the classrooms of core members of the team; classrooms of other faculty; and offices, halls and other locations (including student cafeteria, gyms, places outside the school).[5] Figure 4.4 provides a related breakdown of communication by location,

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5 For the purposes of this location analysis we look only at the core team's rooms because some peripheral team members' classrooms were multi-purpose rooms (e.g., the library) which were the scenes of many interactions without the peripheral team members present. Using these locations would have inflated our data.

Figure 4.3
Communication by Location

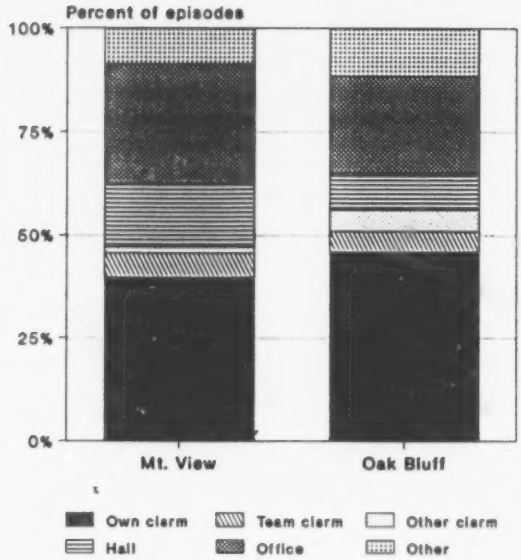
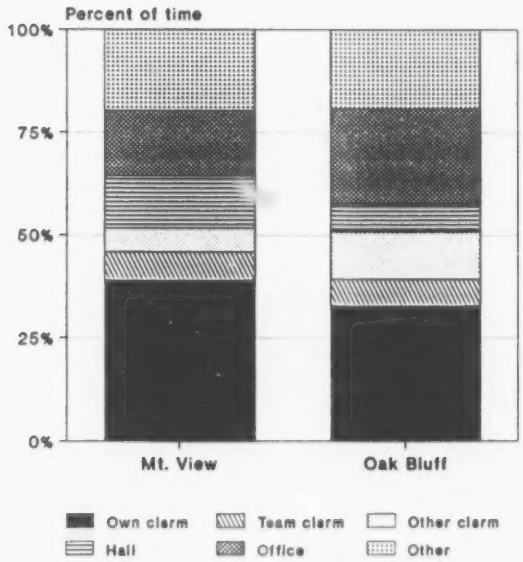


Figure 4.4
Communication Time by Location



this one in terms of percentage of time rather than number of episodes. These quantitative data confirm the observation that the teachers' own classrooms were where they enacted most of their communications, largely because they spent the bulk of their time in them. The figures show that the office was a major center of communication. Halls and other team members' classrooms were used for communication more at Mountain View than at Oak Bluff because Mountain View's A Neighborhood core teachers had adjacent rooms. Thus, proximity is one factor increasing communication. In both schools, relatively little communication was accomplished in other teachers' classrooms because teachers were too busy to get to them often.

What Kinds of People Did Teachers Interact With?

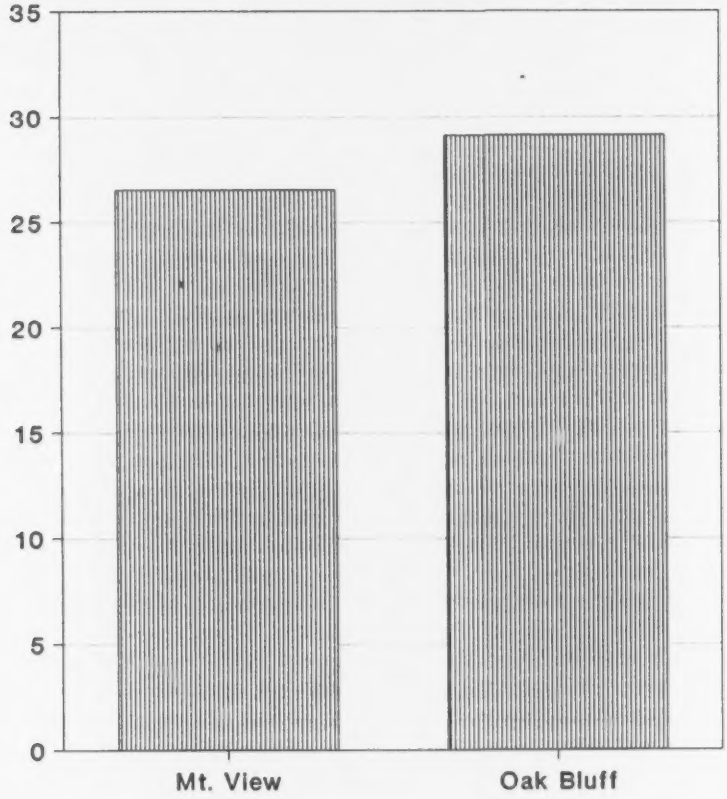
As Figure 4.5 shows, teachers at Mountain View interacted with an average of about 25 individuals a day, teachers at Oak Bluff with about 29. This is an *unduplicated* count of the individuals with whom group members met face-to-face, talked on the telephone, received a letter from or sent a letter to, and so forth. If a person attended a meeting with four individuals first thing in the morning, the count would be increased by four; if that person talked in the hall with one of those individuals later in the day, the unduplicated count would not increase. These statistics include all adults with whom the shadowee interacted, in both close professional associations (co-members of faculty teams) and indirect, transitory relationships (e.g., phone calls regarding equipment, sending notes to parents and reading advertisements for pizza companies seeking business at school events).

There were three categories of adults essential to the teachers in accomplishing the work we studied: team members; other building-level school personnel (teachers, staff, administrators and volunteers); and outsiders to the school (external school district employees, parents, vendors, construction workers, workshop leaders and others).

Daily life in the school provides opportunities for interaction with nearly every individual on the faculty and staff, but individual teachers interacted most frequently with a particular constellation of individuals. For the Mountain View A Neighborhood Team, these were the classroom teachers of academic subjects who had rooms in the same hall. Likewise, for the Oak Bluff seventh grade team, these were other classroom teachers situated nearby but not the other faculty (e.g., counselor) assigned to the team. In addition, some relationships, such as being members of the same discipline or committee, were the bases for frequent interaction. Each teacher interacted directly with every adult in the school, for everyone was expected to attend the same faculty meetings and could leave mail in all the mailboxes. At Oak Bluff, one could send and receive email to any or all teachers and administrators (individually or as part of a list). Teachers exchanged information and ideas with the principal, vice principal and counselors frequently.

Teachers did not transact much business with individuals from the world outside the school. Our informants did not, for example, communicate frequently with district personnel from other schools or offices within the local and regional districts. They did contact district secretaries to schedule substitutes or get information on employment and financial regulations, and district professionals sometimes participated in decisions about resource room students. Among the district personnel we saw them contact were a speech clinician, a school board member and a landscape

Figure 4.5
Distinct Interactants Per Day



architect. The outsiders with whom they most frequently communicated were parents (and grandparents) who usually appeared, wrote or were notified when their child was doing poorly. A teacher who planned to call a parent walked to the office to look up the phone number, jotted it down and usually took it home. (The time and quiet needed for a substantive call were lacking at school, and the success rate of reaching people during the day was low.) Although the roles of other outsiders varied greatly, their number was few. A good portion of teachers' outside business was related to courses, conferences and workshops for earning credits required to retain and upgrade their state teaching certificates.

Figure 4.6 provides an overview of teachers' communication with adults in each of these social categories. [6] What is immediately striking about this figure is the similarity between the two schools. While communication with members of the core teams comprised about 20% of the communication, nearly 66% of the communication was with other staff members. The remaining percentage (approximately 14% and 13% for Mountain View and Oak Bluff respectively) was communication with adults outside the school buildings. We believe this pattern results from the similarity of social structure in the two schools (and most other public middle schools). Common roles, statuses and job assignments (as well as resources and values instrumental for carrying them out) influence communication in both schools to a great degree.

If we examine channel use by social category for Mountain View (Figure 4.7) and Oak Bluff (Figure 4.8), several interesting patterns emerge. First, there is some similarity between the two schools in face-to-face and phone channel use with two social categories. Over half the communication between teachers and non-core team staff is accomplished through face-to-face communication, while about one quarter of the communication with outsiders took place through this same channel. In both schools proportionally more communication with outsiders was accomplished through hardcopy than through any of the other available channels. Given the amount of mail teachers receive from vendors, publishers and educational institutions, this is hardly surprising. One interesting difference between the schools is the proportion of phone communication with outsiders. Mountain View teachers used the telephone for only about 12% of their outside contacts, while Oak Bluff teachers' communication with outsiders involved the telephone about 31% of theirs. These figures need to be interpreted in light of the fact that in nearly all schools teachers tend to take their phone work home with them. Calls to parents (returned and initiated) are often difficult to arrange given parents' daytime schedules and teachers' problems of access to telephones in school. Some teachers reported that they occasionally make as many as four or five calls each night. Obviously, the data we collected on phone use exclusively during the school day mask the importance of the telephone as a channel for work-related contact with outsiders at other times.

In addition, the contrast between the two schools in terms of phone use can be at least partly attributed to the fact that many of the phone calls at Oak Bluff were made by the teacher responsible for operating and maintaining the computer network. With a telephone and separate outside line available at her desk, this individual's use of the telephone increased the overall number of calls to outsiders. Not surprisingly, the telephone was not a significant channel for communicating with core team or other building staff in either school.

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6 A fraction of the episodes observed were compound episodes in which the same interactants were involved in the use of two channels; the number of events in a particular channel may be greater than the number of episodes. Consequently, we focus here on the episodes in each channel as a percentage of all the events in each channel.

Figure 4.6
Communication by Social Category

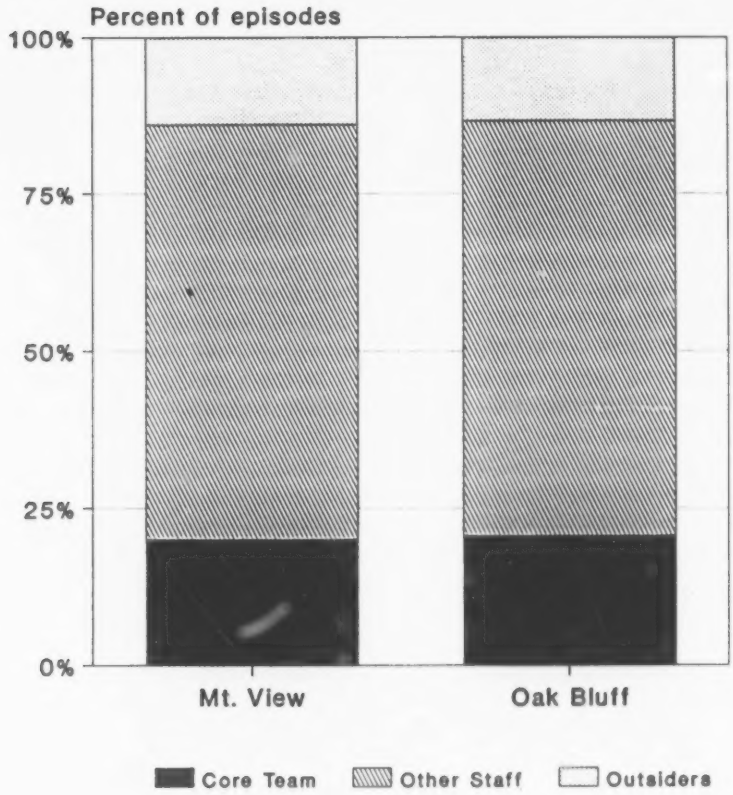


Figure 4.7
Mt. View Channel Use by Social Category

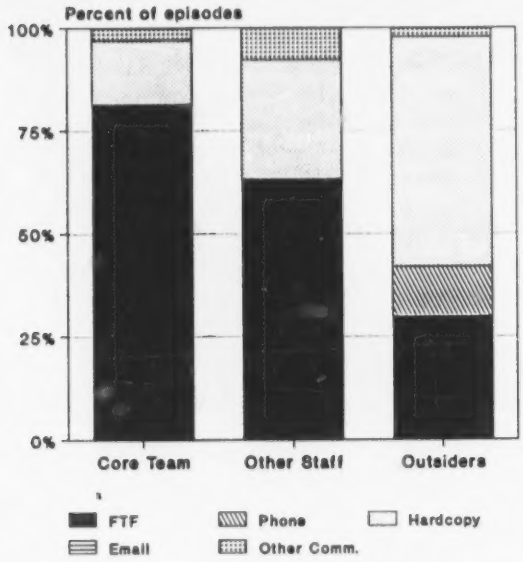
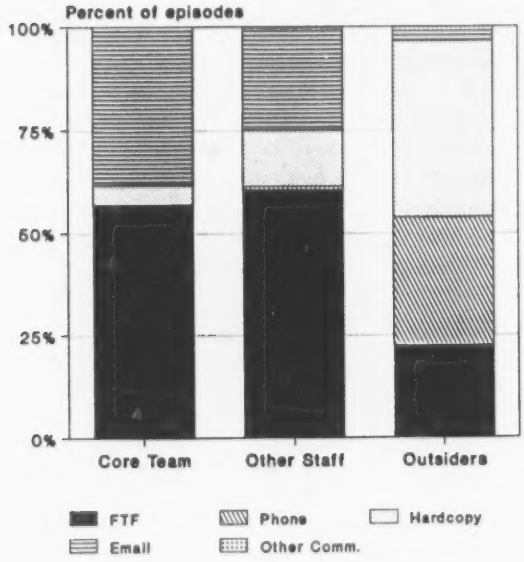


Figure 4.8
Oak Bluff Channel Use by Social Category



One other interesting pattern emerges when looking at channel use by social category. The quantitative data strongly suggest a pattern we observed in our qualitative observations: electronic mail at Oak Bluff appears to replace hardcopy and, to a lesser extent, face-to-face communication among core team members and other staff. Looking first at communication among the Oak Bluff core team members, over 38% of their communicative interactions were accomplished through electronic mail while less than 5% through hardcopy. The balance of communication (57%) was face-to-face. Among Mountain View teachers (where electronic mail was not available), on the other hand, over 81% of the communication involved face-to-face interaction and over 15% hardcopy.

Data relating to communication with non-core team staff suggest that email at Oak Bluff replaces some of the hardcopy communication. While intercom and temporary and permanent displays account for nearly 8% of the communication between teachers and non-core team staff at Mountain View, communications which would otherwise be carried through the same channels at Oak Bluff appear to be carried through electronic mail.

Figures 4.9 and 4.10 portray communication among adults during class time. Obviously, most of the teachers' attention and energy are consumed by instruction and class management activities during these periods, but some communication with other adults does occur. When we look at the types of individuals and the channels which comprise this communication, several interesting patterns emerge. When a teacher at Mountain View communicates with another core team teacher that interaction tends to occur through the face-to-face channel (83%); Oak Bluff teachers tend to communicate with core team members through electronic mail (56%) or to a lesser extent face-to-face (37%). The proportion of face-to-face communication with other staff during class periods is similar for both schools (57% for Mountain View and 53% for Oak Bluff), but electronic mail is again prominent at Oak Bluff (34%), apparently replacing hardcopy and other channels of communication. The researchers were able to read the shadowed teachers' email as they wrote and read on the screen. In addition, the collected email informed our understanding of message content. It was evident that most messages were replacing hardcopy or face-to-face interaction. Many messages entailed: 1) arranging future meetings, a task which would have required documents or conversation if there had been no email; 2) transacting business which could have been part of a meeting were it used for email; 3) discussion of teacher plans and reactions which were the topics of conversations when teachers were together. It appears that at Mountain View, if a teacher contacts any adult, interaction was apt to be face-to-face. Given the physical structure of neighborhoods, there is a greater likelihood of contacting other team members through this channel since the other team members tend to be in proximate classrooms.

During class time at Oak Bluff, teachers contact team members through email but have fewer face-to-face contacts because their classrooms are not as close as they are at Mountain View. Other staff, on the other hand, are able to drop in because their classrooms are nearby and the teaching style is more informal. As noted before, the overall greater proportion of telephone interactions with outsiders at Oak Bluff appears to be a result of the availability of the telephone and use by the teacher with the responsibility for computer support.

Figure 4.9
Mt. View Class Time: Social Categories

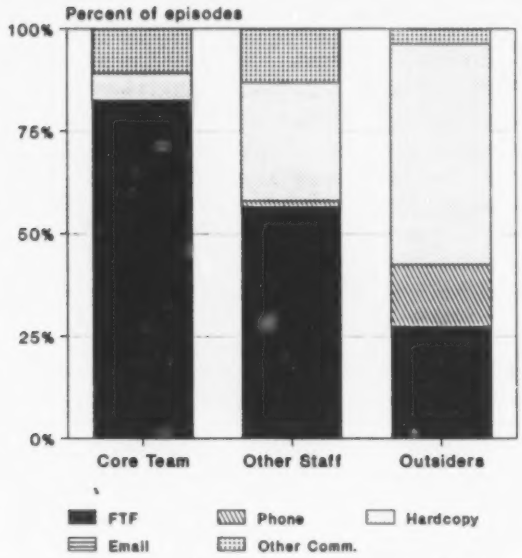
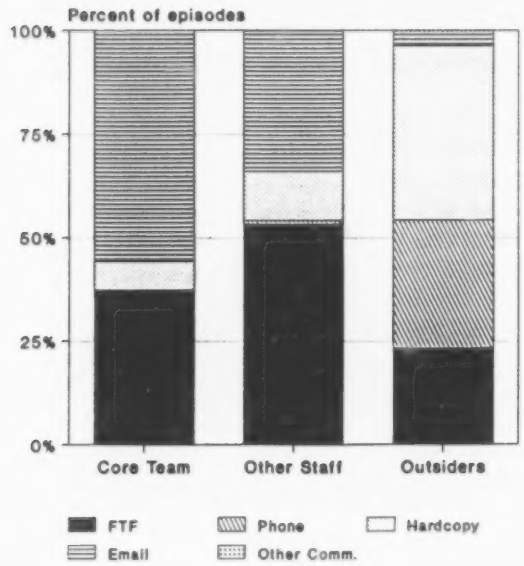


Figure 4.10
Oak Bluff Class Time: Social Categories



Figures 4.11 and 4.12 provide another perspective on communication in terms of social categories, focusing on the locations within which communication occurs among teachers and members of their core team, other staff and outsiders. Before attempting an interpretation of these data, it should be pointed out that locations and channel availability are closely related. For example, as we saw above, telephones are not normally available to teachers in locations other than the main office or possibly in the faculty lounge. Since teachers spend the majority of their days in their classrooms, their access to phones is limited for much of their workday. Consequently, as we would expect and as these data show, most of the communication with outsiders takes place in the office area where telephones are located.

Mountain View teachers communicate with members of their core team in and from a variety of locations; nearly equal proportions are initiated or received from individuals' own classrooms (28%), classrooms of team members (25%) and from the hallway (24%). Oak Bluff teachers accomplish slightly more than half (51%) of their communication with core team members within their own classrooms. The balance of communication with other core members takes place predominantly in the classrooms of other team members (12%), in the office area (14%), hallways (7%) and other areas. Once again, differences between the two schools seem at least partly shaped by the availability of electronic mail to Oak Bluff teachers. Using electronic mail, teachers are able to conduct much of the communicative work required to complete team tasks from within their own classrooms; the other locations were thus less important as venues for interaction. Similarly, the neighborhood organization at Mountain View increased the likelihood that interactions with core team members would occur in the hallways since their classrooms tended to be located in the same area of the building; core team classrooms at Oak Bluff, it will be remembered, were distributed throughout the building.

What Kinds of Time Were Available for Collaborative Work?

The schools delineated periods and locations, employing them as tradition and community expectations prescribed. These social constructions of time and space had a strong impact on staff members' control over their own activities, including their communication. In spite of these delineations, teachers sometimes engaged in activities that did not readily "fit" the kind of time (for example, getting coffee during a class period or teaching math to a student after school). Nevertheless, these structures did prevent them from doing much that did not "fit." Lunch period, however, was not what an observer from outside the school might expect: it was less a time for food and personal conversation than a time to catch up on individual and collaborative work.

At every turning point bells determined the time period and thereby influenced the type of work teachers took up. A visiting professional not used to a rigid hourly schedule might be startled by the bell's tyranny. From the teachers' point of view, accepting the time slots as a given, there is minimal flexibility: one could ignore the bell for a moment to finish a conversation.

Figure 4.11
Mt. View Locations: Social Categories

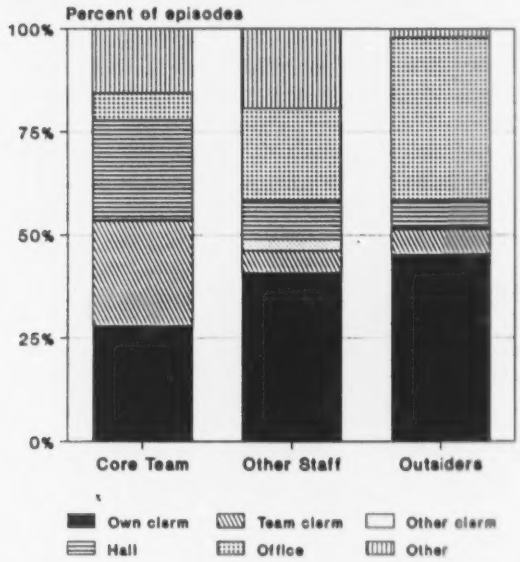
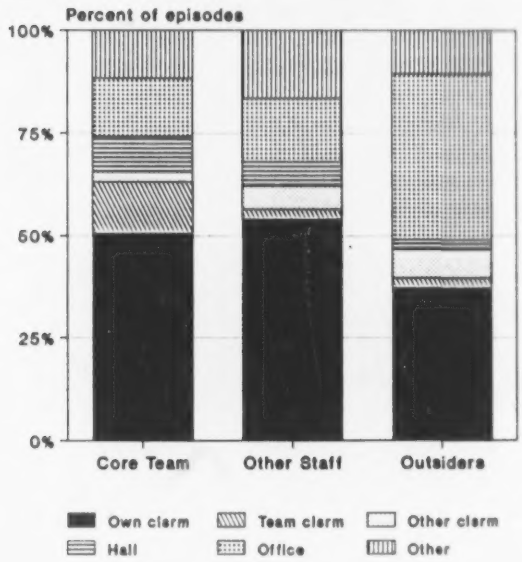


Figure 4.12
Oak Bluff Locations: Social Categories



Individuals responded to the bells and periods differently. One teacher took the passing bell before the first class as her deadline for arriving at school, but most heeded it as a warning that they needed to wrap up whatever they had been working on before school and get ready for the onset of the first class. One teacher religiously fulfilled his hall duty obligation by standing outside his door from the bell beginning a passing period until the bell ending it. Most teachers had too much business to transact to spend passing periods in this way.

During the fifteen-minute A.M. period at Oak Bluff, the science teacher allowed her students to chat and work while she took care of business in and out of her room--scurrying to the photocopy machine, mail boxes and other teachers room, or organizing her desk, reading and responding to email, calling up on the computer students' grades for them to look at and reading notes from parents. During the same period the math and computer teacher, who had no class due to her extra duties as faculty computer consultant, traveled to other rooms to answer teachers' computer questions or stayed in her own room and worked at her desk.

People were very conscious of the schedule. Variety was created purposely by the inclusion of weekly A.M. classes, Late Start Days, assemblies and so forth. Because there were so many daily schedules to choose from, a bulletin published the upcoming ones for the next week, whether or not they were regular. Teachers sometimes referred to these printed schedules during class to determine how long the period would be.

A major aid to team collaboration at Mountain View (but not implemented at Oak Bluff) was the common prep for members of each team. Neighborhood Team teachers were available to each other every day during fourth period for informal or formal meetings. During this time they tended to work at their desks, pick up their mail, go into others' rooms to exchange information and take brief coffee breaks. Some days they held a meeting to discuss student cases. These meetings were rather formal: the team leader or counselor facilitated, notes were taken and demeanor was serious. Depending on the task at hand, the student, parents, counselors and administrators were included. The common prep supported team interaction but sometimes decreased time available for members of the same discipline to work together. Teachers regretted this. In the school year following our data collection, the neighborhood team members no longer had a common prep period, reducing the amount of collaboration they reported being able to do. This alteration was a result of the need for a common prep for members of the same disciplines to work on curriculum for standardization review. Thus the potential for the team to work on cross-disciplinary curriculum and student "casework" was decreased.

Teachers developed diverse strategies for handling their time. They came early, stayed late, closed the door during prep, ate in the faculty lunchroom to catch up on business or employed other habits to help juggle the load of things to do.

The strategy used by the Mountain View math teacher in particular was to concentrate on work at his desk for an hour or two before school. In the winter he came even earlier and stayed late because he added basketball coaching to his load. During part of his class periods, while students practiced skills he had just taught, he sat at his desk and fielded their individual questions alternately with reading his mail, grading, etc. During passing periods he went to the nearby production room for coffee, then stood in the hall by his door and chatted with people going by. Here he often contacted the other math teacher and shared curriculum ideas; once he

picked up an idea for an assignment called "Shop 'til You Drop" this way. The team leader's strategy was to arrive about half an hour early every day and spend much of her non-class time communicating with faculty about team business and social studies content. Because of the time demands of her role as leader, the administration had arranged for the shop teacher to relieve her of class duties every Monday morning for about half an hour so that she could plan lessons. On the days she ate in the faculty lunchroom she talked shop with the teachers she happened to sit by. Invariably, her arms were loaded with papers to grade as she walked to her car around five each afternoon.

The qualities of the schedule are analyzed below and illustrated with examples of behavior they influenced.

The schedules were imposed upon teachers. *Fran Moore, the A Neighborhood science teacher, who had been teaching health and science for about 30 years and was due to retire the following year, organized her instruction using a standard lesson plan book which displayed her time by weeks and class periods (but not hours as they appear on the planning calendars of professionals other than teachers). She jotted names for the time slots according to the periods the administration set in September. The hours were less significant, for bells announced period changes. In fact, school people seldom referred to the hours when telling time but named the period instead.*

At each site the administration, with faculty input, created a weekly schedule within which teachers had to operate. Each day had the same general outline of seven to eight classes daily: 45-minute class periods, five-minute passing periods, one 45-minute prep period for each teacher, and lunch (two half-hour periods with half the faculty assigned to one and half to the other). In each school the schedule was fine-tuned to meet the particular needs at that site: the result was a set of daily schedules. Thus, in Mountain View, Monday was Late Start Day, with children arriving at 9:15 so that neighborhood teachers could meet, and Wednesday was Advisory Day, with an extra period for a homeroom class. In Oak Bluff no distinctive schedule allowed for faculty team meetings, so that meetings had to occur before or after school, but a homeroom period called "A.M." occurred on Tuesdays.

From a teacher's vantage point, the schedules were arbitrary. *One afternoon during her eighth period English class, while an aide was circling her room to assist students working independently, Molly noticed that a girl (who previously had attendance and discipline problems and whose parents were believed by several faculty to be drug dealers) had cigarettes sticking out of her pocket. Regulations required that Molly confront this infraction of rules and continue class. Since she was not directly addressing the class, she was able to call the girl into the hall to speak with her and take the cigarettes away.*

When the girl was settled in class again, Molly consulted a policy book which did not clearly explain procedures, so she sent email to the principal and vice principal, asking them what steps to take. When they did not answer, she sent email to the secretary asking whether the administrators were in. The secretary responded that the vice principal was in. Molly replied to the secretary asking her to tell the vice principal to answer. After a few minutes without hearing from the vice principal, Molly sent an email message to the counselor. It was now half an hour since she had sent the first message. In five minutes a student aide arrived in the room with a hall pass directing the cigarette possessor to go to the counselor's office. After school the counselor came to Molly's room to discuss the case.

The schedule, designed to support instructional work, arbitrarily limited the teachers' options for attending to social and organizational work. Bells curtailed conversations and directed people to locations where certain tasks could not be accomplished. In Oak Bluff, however, technology sometimes allowed teachers to circumvent this arbitrariness: by using the electronic network they could communicate during classes.

The same general schedules were observed by all faculty. *In Oak Bluff both Sharon Crown, the resource room teacher, and her colleague Johna Paulson, who taught science down the hall, followed the same general schedule. Yet their job assignments (and professional training) were extremely different. Each period Sharon was in charge of a class of students needing special instruction as well as two aides who helped her deliver it. In tailoring programs for individuals, she communicated with her students' "regular" teachers, the administrators and counselor, and professionals outside the school. In contrast, Johna had a conventional class format in a laboratory-equipped room, many scientific materials and projects to oversee, and no extra responsibilities to provide special education.*

For the most part, all teachers, no matter what their duties, had class or prep during the long periods and breaks during the short ones. On first glance this similarity would seem to make all the adults accessible to each other during breaks, but distance among rooms, quantity of work and urgent business reduced the accessibility so much that during most breaks a teacher saw only those in nearby classrooms unless he or she rushed to other parts of the building.

The schedules were inflexible. *Fran Moore, the team science teacher in Mountain View, needed to list her students who had failed to turn in adequate work and were therefore disqualified from participating in Success Period. In order to write this "d.q. list", she needed to be "up" on her grading. Fran stayed in her classroom all lunch period (her usual procedure) to work on this. Several times during the afternoon she went to other team teachers' rooms to give them her list and to find the main list, a compilation of all names being added. (All team teachers needed to have access to the others' lists because a student could have make-up work in several rooms during Success Period and they would have to coordinate this movement.) After the list was created, students' names could be crossed off if they turned work in, so communicating about the lists continued until Success Period began several days later.*

Each day the schedule was pretty much the same, providing long classes and short breaks. Yet some days were dominated by jobs that lent themselves to being done in bits and pieces (as one day when math teacher David Kawa spent his spare moments opening dozens of envelopes with donations for the Math-a-thon) and other days were dominated by jobs demanding longer periods of concentration as well as collaboration (as when a girl with a history of severe psychological problems wrote a disturbing note to one of her teachers, and did not go home after school as expected). The daily schedule remained invariant though the daily work varied radically.

The schedules created a rhythm of "free" periods full of communication alternating with class periods with little communication.

"Free" time. On the morning of Wednesday, April 25, Molly Schneider, social studies teacher and leader of the A Neighborhood Team, arrived at school and picked up her mail in the mailroom. She looked at the eight items, read a posted list of honor students, photocopied it and headed down the hall to her room. Along the way she ran

into a teacher who told her of another teacher looking for her and stopped to hear Fran Moore declare that she was satisfied to see that her good students had made the honor roll. Upon reaching her room, Molly re-read her mail, then proceeded further down the hall for coffee in the production room (where aides prepared instructional materials for teachers). Back in her room she set up a film, talked to an early student, read the daily bulletin, and planned curriculum.

Class time. Molly's morning classes were interrupted for adult communication only when she: sent and received hall passes for students who needed to be excused; heard an intercom announcement from the counselors' office that "there will be no Rap Session today;" received a stack of Jr. Scholastic magazines from another social studies teacher; sent the roll to the office; and read the office's list of absent students. Except for these brief encounters, she taught students all period each period. During Advisory class she accompanied her students to the gym for funnyball and coached them by telling them when to rotate (as in volleyball). She had to ask another "coach" when this should be done; otherwise she did not talk with the other faculty there.

"Free" time. Molly and all the A Team members had prep during the school's fourth class period. As she and Anne Harris, a team English teacher, were considering their plans to "do" units on Asia and Jackie Robinson, the vice principal dropped by and confirmed the importance of planning cross-disciplinary ideas, reminding them of an upcoming meeting on that topic. Alone again, in the next ten minutes Molly did some photocopying, dropped off the cross-disciplinary ideas on the desk of one of the team's English teachers, and read the textbook. Fran dropped by to report on the uncooperative behavior of three girls who often were the subject of team conferences and "gripe sessions." When Fran left, Molly went back to her text. Once more Fran came in to talk. After she left, Molly read until the lunch bell rang.

During lunch period Molly sat at one of several round tables in the faculty lunchroom, eating silently while the three others there chatted about musical talent, tempers, and track. Two departed, leaving Molly and an experienced, older math teacher. They talked "shop," addressing the difficulty of offering children special sessions of their choice when it is so hard to control the behavior of kids who are not one's own students.

Class time. After lunch the class-break-class pattern continued for two more periods. Molly communicated with kids and remained isolated from adults.

"Free" time. The after-school time repeated the free "beat" of before-school time. Among Molly's activities: another talk with Fran about "problem" students; a discussion of curriculum on the Middle East and Africa with the other social studies teacher; picking up and reading a new batch of mail; writing instructions for a substitute; and sorting papers to grade. Finally at liberty to choose which task to work on, where to go and whom to seek, she worked on twenty-five separate tasks, ranged across half the building, talked with seven adults and sent or received 13 written communications. After a serious talk with David Kawa about school and district politics, she packed an eight-inch-thick pile of papers to grade at home. (She expected another stack of equal size to be turned in the next day. All had to be graded before term progress reports--due in a week--could be written and sent to parents.) At 4:30 she headed toward her car.

School days were characterized by long class periods of isolation from adults punctuated by short break periods of intense communication. Since much of class time was taken up by direct instruction of students, break time was pressured by the demands of curriculum work, student support services and organizational maintenance.

Moments in which teachers chose what to do were scarce. *One day Wayne Moffitt taught his six English classes in Mountain View for a total of four hours and 13 minutes. During that time the only contact he had with adults were brief, indirect encounters, e.g., receiving a hall pass which a teacher had initialed. The 40 minutes of passing time came in five-minute "installments". And there were limits in addition to time limits on his alternatives for passing periods. For example, there was the school expectation that teachers, whenever they had no urgent business, stand by their hall doors during passing period. Here he signed kids' forecasting forms (requesting classes for the next year) and chatted with adults and students. In order to increase instructional time, he slipped into his classroom to take attendance right before the class bell rang. Thus his only real discretion was during the 45-minute prep period and lunch, half of which he spent working. He arrived at school an hour before classes started and stayed an hour after they ended, time he could schedule as he chose. The final calculation for this eight hour day: almost five hours scheduled for Wayne and four hours (including lunch) scheduled by him. This was an unusually "free" day in that he had no obligation to go to a team meeting or handle a social crisis.*

During the short "free" periods, if a teacher didn't need to take care of personal needs, he or she often faced regular duties or pressing situations (e.g., a student needing help on a math concept for a test next period or a print-out of grades or parents in the office who wanted to talk). Longer "free" periods (before and after school, prep and lunch) were times for scheduled meetings, handling unforeseen social "crises" and teacher choice.

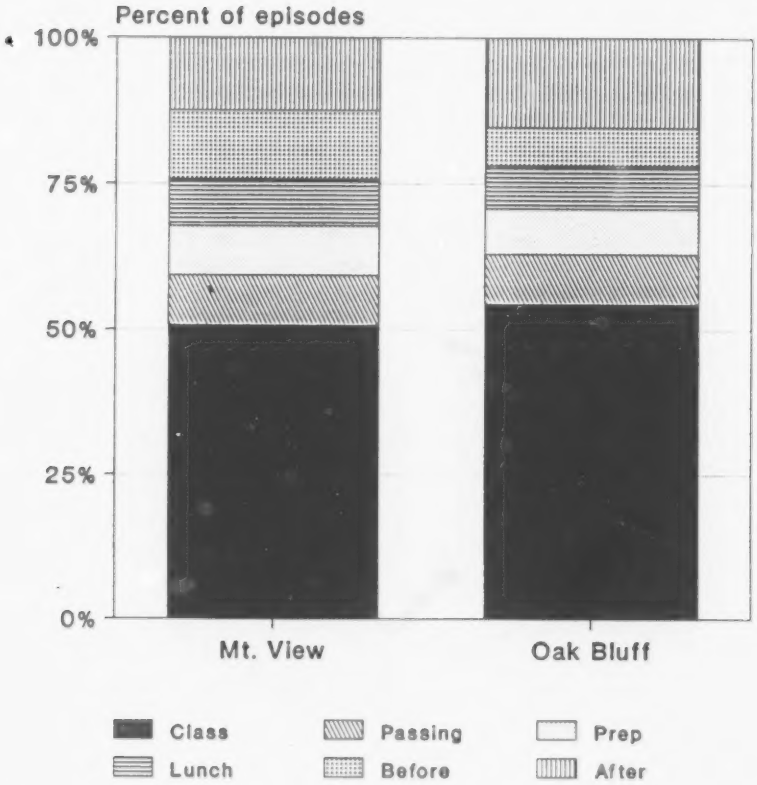
The types of time were the same in these two schools as in so many schools across the nation--class, passing, prep, lunch, and before and after school periods. The schools were very similar in the way they used these time categories. With respect to their communication, we see in Figure 4.13 that most of it occurred during class periods and that the rest was quite evenly apportioned among the other kinds of time. This is due in large part to the great amount of the workday allotted to classes: slightly more than 50%. It's significance for communication is clear: teachers interacted with adults to conduct school business during instructional time.

What Channels Were Used for Communication?

The eleven shadowed teachers' communication can be viewed through their use of five channels: face-to-face, phone, hardcopy (paper), electronic mail, and other (written and graphic displays and intercom). The technologies supporting these channels are described in the field setting section above.

Face-to-face communication was the major channel for non-teaching work. People sought each other out across wide gaps of space and time to initiate or continue conversation on certain tasks. Cursory notes dropped in mailboxes (which were far away from classrooms) often could not suffice for the kind of exchange they desired. Consider the talk of one teacher as we trace it through a composite day. In the morning she arrives at her mailbox; if she is not extremely early, she sees another teacher there and chats briefly. On the way down the long hall to her room she exchanges remarks on the weather or some mail item (she has been reading as she walks). She works for a while in her room before she leaves to find out something from another teacher or someone comes in to talk to her. During at least one passing period and one class period she goes out of her way to locate a certain adult to expedite some planning matter. At lunch she stays in the room to do paperwork

Figure 4.13
Time Categories



but ventures out for food and conversation for at least a few minutes. After school she may have a meeting which is entirely face-to-face communication. She heads back to her room to work and collect her things but ends up talking about the meeting before heading home.

Inside the schools, paper documents were almost as important as face-to-face conversation. Teachers exchanged dozens of hall passes, minutes, lists of students and announcements. For communicating with outsiders who often were inaccessible in person, documents were more important than face-to-face conversation. Parents sent and received notes about homework. People whom teachers did not know sent advertisements and requests for donations.

Telephones were few and far between. The math/computer teacher at Oak Bluff and the resource room teachers in both schools were exceptional in having phones at their desks. Others had to walk to the main office, faculty lunchroom, or, at Mountain View, the production or team room to make or receive a call. Teachers talked about the difficulty of making professional calls. One day a teachers' magazine with an article about the possibility of phones on teachers' desks lay on a lunch table and the teachers who scanned it were very enthusiastic about the prospect.

Teachers at Oak Bluff typically used their email system many times a day. If time categories and locations were "walls" cutting off communication, the email system was a means for leaping over these walls. Without leaving the room or waiting for a "proper" period for adult/adult interaction, one could type out and send a message. The receiving teacher could call up and read it at convenience. If the sender designated a message as urgent, the "envelope" announcing the message on the receiver's screen revealed this, so immediate response was feasible. Email was a noteworthy antidote to the loneliness mentioned frequently by teachers. A few teachers, including two whose rooms were next door to each other, wrote long, emotional letters about school business to each other and short, pithy ones expressing their feelings. Our research did not reveal any instances of teachers becoming "glued" to the screen and neglecting their classes. On the contrary, they used the network to expedite business which would have taken more time, some of it class time, to accomplish with other channels. One example is arranging a meeting to orchestrate a recreational activity off campus for the last school day of they year. Via email the seventh grade team discussed every aspect of the arrangement: the appropriateness of movies ("Pink Panther" and "Ninja Turtles"); detaining students who had not finished their work; which teacher should get to stay on campus with kids who didn't go; and so forth.

The computers on teachers' desks offered diverse options which are still unusual in a school, including programs for compiling grades, creating curriculum and "conversing" with others in the building on an electronic network. Only these talks classify as communicative activity for our research. The email program provided a screen format much like a paper memo form on which a teacher could type a message of any length. The receiver saw a picture of an envelope on the screen telling the sender and topic of the message. A beep announced the arrival of the message unless the teacher turned it down very low or off. Teachers typed messages to fellow team members or other colleagues at all times of the working day,

including class periods when students were working without direct supervision. Messages were exchanged for a variety of purposes, such as to:

- get a counselor to talk immediately with a student found in class with a pack of cigarettes
- ask the attendance secretary whether a particular child was absent that day
- summon the computer support teacher to figure out how to use a computer program for creating a crossword puzzle from a list of terms and their definitions
- apologize for a mix-up about who was supposed to supervise students collecting plastic milk jugs for recycling
- request that a teacher send information on her students' final exams so that resource room aides could help those in the resource room who have that teacher
- schedule a meeting on a student who is failing
- let off steam after a tense class session

The other channels were the intercom system at Mountain View and temporary and permanent displays posted on walls. Temporary displays were agendas on chalkboards, minutes of meetings on bulletin boards, job announcements on doors, and other timely information. Permanent displays were the staff birthday list, the staff schedules, a list of committees and information useful for a longer time period. Displays were rarely critical information. The intercom was used to call teachers (and students) to the phone and announce the time to dismiss classes for assemblies. During many of our days in the field the intercom was not used at all. At Oak Bluff, where there was no intercom, these functions were filled by the email system and face-to-face interaction.

Now we focus in on the microstructure of channel activity and time. We examine various aspects of the fine temporal structure of activity: the number of observed episodes comprising an activity; the aggregate time across the episodes constituting an activity; and the mean duration of those constituent episodes. Although these three ways of assessing time are closely interconnected, they offer somewhat distinct perspectives on the fine temporal organization of activity. As explained above, we are looking at all the work the teachers did which was not instruction or working with students on one's own lesson plan or grading. We call this non-teaching activity, the subject of all our observations. Within non-teaching activities there are communicative activities and other activities. Communicative activities are the actual sending and receiving of information; for purposes of analysis we have classified them into five types: face-to-face, phone, hardcopy, email, and other communication. Other communication includes intercom and permanent and temporary displays. Other activities are those non-teaching activities which are not directly communicative (not the actual sending and receiving of communication). These include reading, writing, photocopying and other activities which later became the basis for communication.

Figures 4.14 through 4.18 display the distribution of non-teaching communication and other activities. In Figure 4.14 we see that about 44% of non-teaching episodes occurred in face-to-face, phone, hardcopy, email, and other communication channels. In Figure 4.15 we see that about 80% of non-teaching time occurred in the same categories. Episode distributions are more informative here than time distributions because the amount of time to send and receive messages can be minimal while the number of messages sent and received can be great. Figure 4.16 shows the average duration of episodes in each category. Other activities are longest because they include the creation and observation of written messages, acts which often take more time than do sending and receiving.

The next two Figures, 4.17 and 4.18, display communicative non-teaching activities in each channel as a proportion of all communicative non-teaching activities. Face-to-face, as observed above, is the dominant channel in terms of percentages of both episodes and time. Although the difference between schools in percentage of face-to-face communication is not great, the slightly lower face-to-face percentages at Oak Bluff may be the result of the presence of email as an alternative channel. In other settings we know email substitutes for both phones and hardcopy (Reder and Schwab 1989a). In these schools, since phones were not available to teachers at all times, the main effect of email on channel choice seems to be to reduce use of hardcopy.

The next set of eight graphs displays the distribution of channel use in each time category. The similarities between the schools seem to be so strong that the differences in channel use by time category, though real, are just one part of the description of the temporal structure. To examine these differences we first look, in Figures 4.19 through 4.22, at non-teaching communication activities as a proportion of all non-teaching activities. Communication occurred in a slightly greater percentage of non-teaching episodes and time at Oak Bluff than at Mountain View. On the basis of our qualitative observations in the sites, we expected to see this quantitative difference because teachers at Mountain View were more apt to monitor students in the halls during passing and therefore more likely to stay away from their desks and the office. At Oak Bluff, teachers did get to their desks during passing, and their communication there was facilitated by a channel which was not available to their Mountain View counterparts.

We narrow our focus in Figures 4.23 through 4.26 to non-teaching communication in each channel as a proportion of all non-teaching communication. The Mountain View percentage of hardcopy communication during prep (30%) contrasts with that at Oak Bluff (9%). This is at least in part a consequence of the paper work of running the neighborhood team activities (notably, Success Period) and the higher proportion of at-risk students at Mountain View.

Now let us look at the quantitative data on email which is used in every time category at Oak Bluff. Although it may replace some kinds of communication in other channels, it also serves to potentiate, expedite and reduce other kinds of communication. For a teacher the approximately 25% of classroom communication in this channel represents a line to the rest of the school enabling him or her to collaborate on academic and social tasks while holding class or doing individual desk work. These numbers reveal that similarities in channel use reign not only across the two schools but also to a considerable extent across time categories. There are, however, some interesting differences.

Figure 4.14
Activities: Episode Distribution

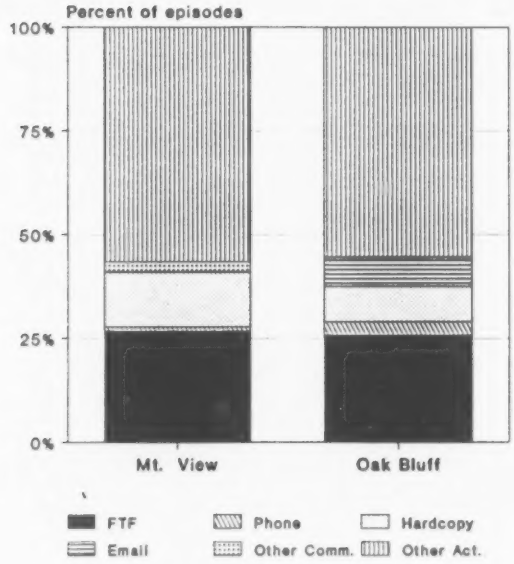


Figure 4.15
Activities: Time Distribution

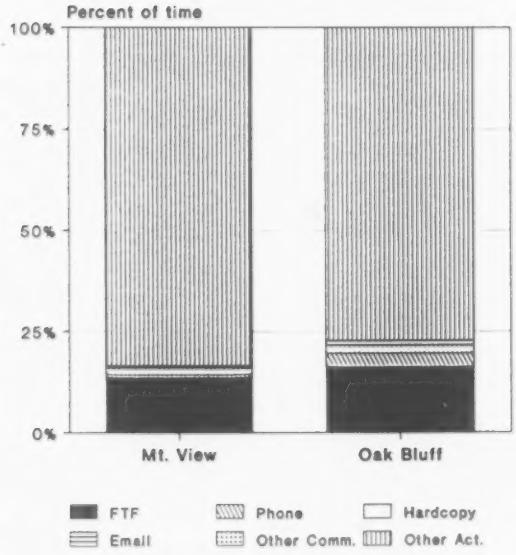


Figure 4.16
Activities: Episode Duration

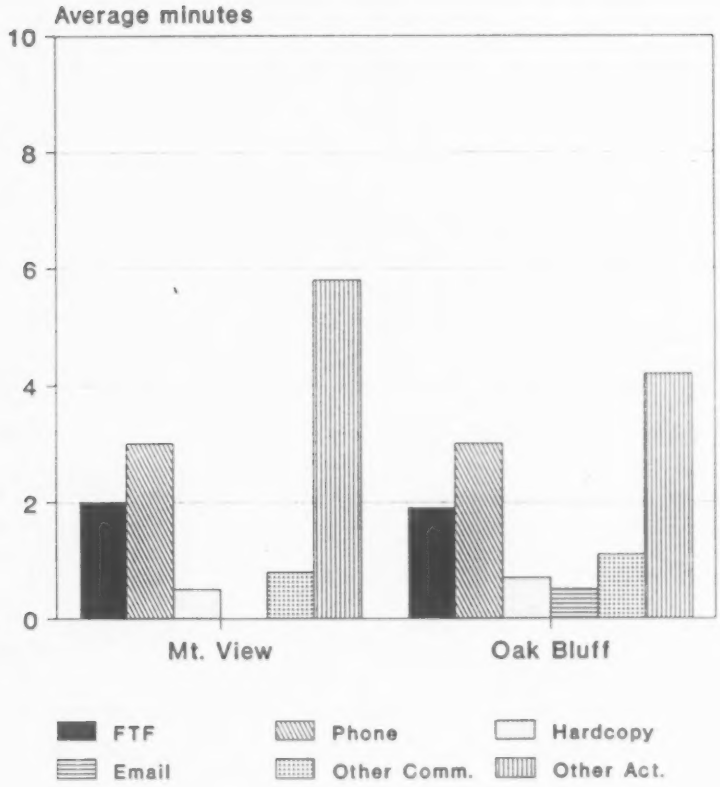


Figure 4.17
Communication: Episode Distribution

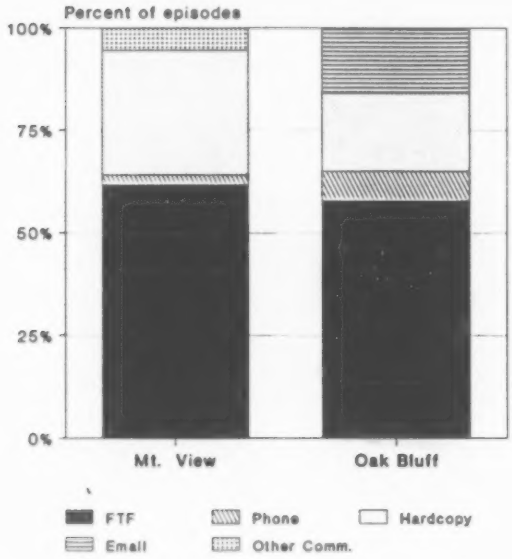


Figure 4.18
Communication: Time Distribution

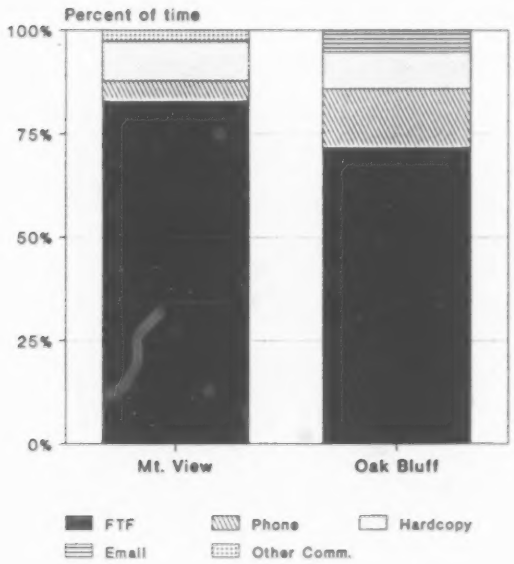


Figure 4.19
Mt. View Activities by
Time Category (Episodes)

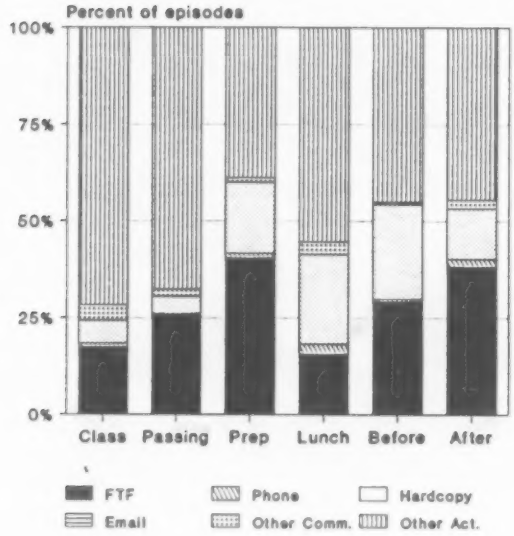


Figure 4.20
Oak Bluff Activities by
Time Category (Episodes)

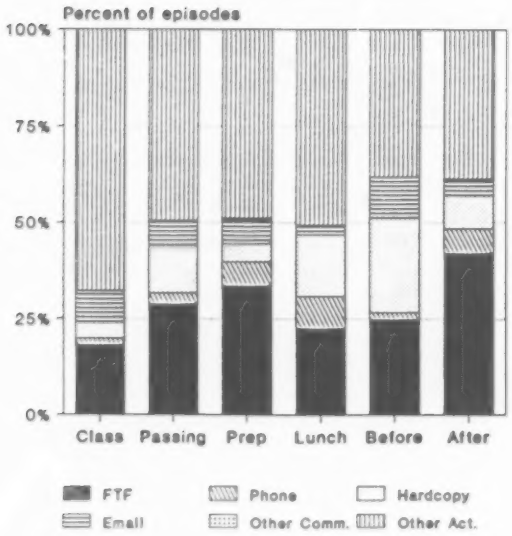


Figure 4.21
Mt. View Activities by Time Category

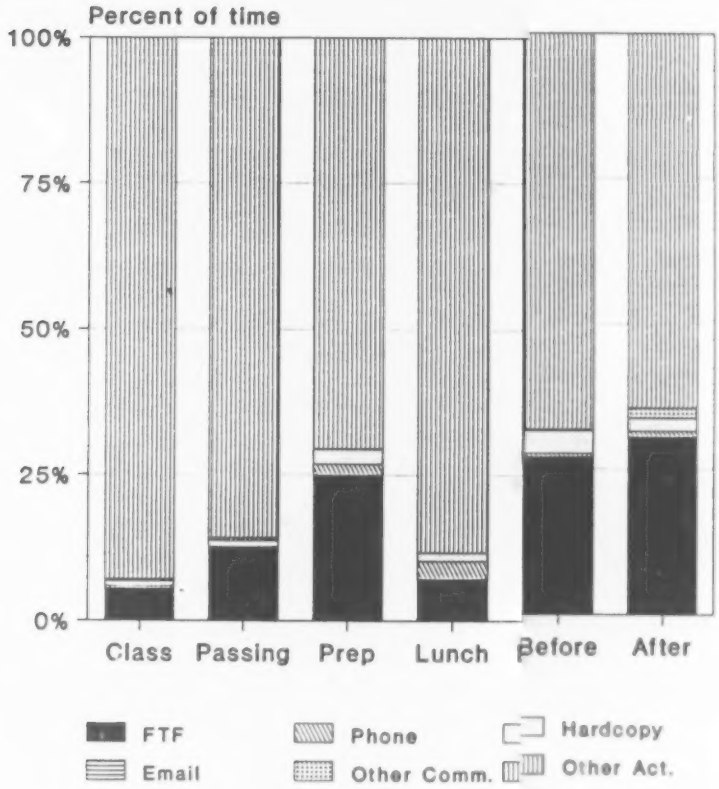


Figure 4.22
Oak Bluff Activities by Time Category

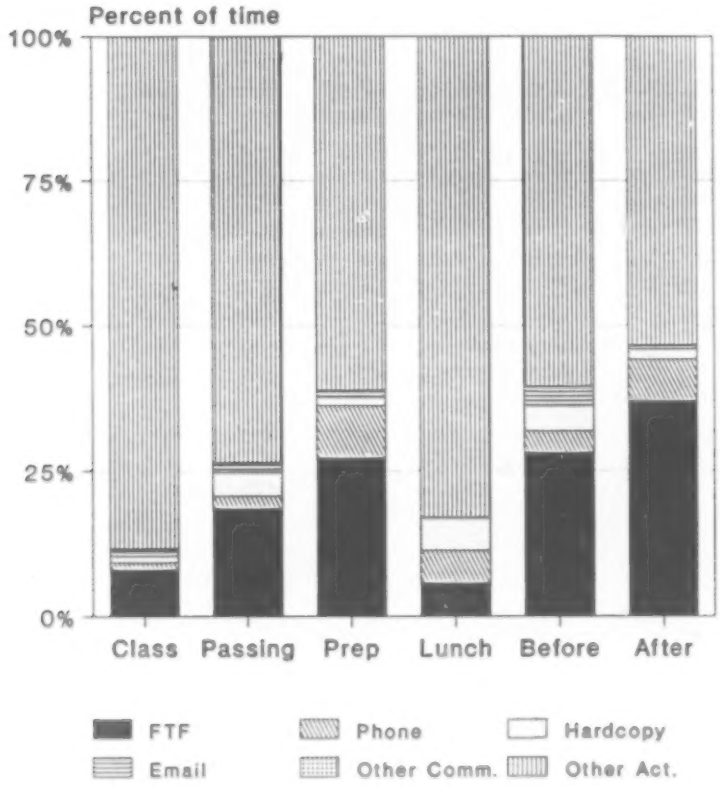


Figure 4.23
Mt. View Communication by
Time Category (Episodes)

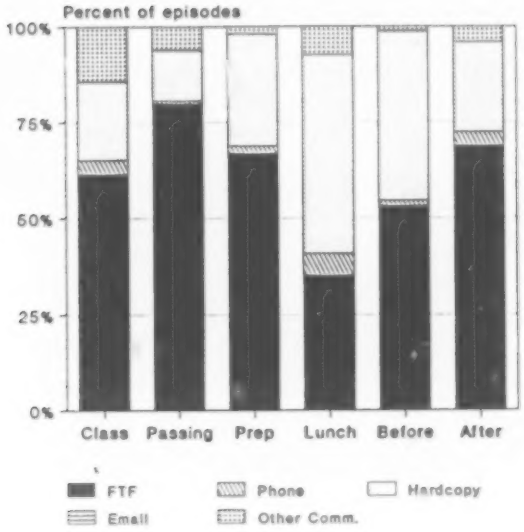


Figure 4.24
Oak Bluff Communication by
Time Category (Episodes)

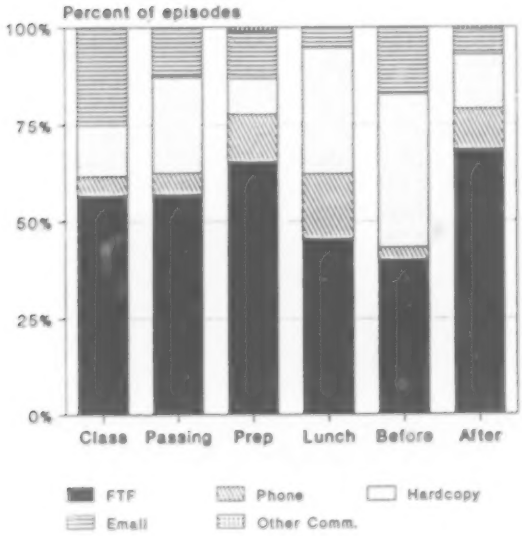


Figure 4.25
Mt. View Communication by Time Category

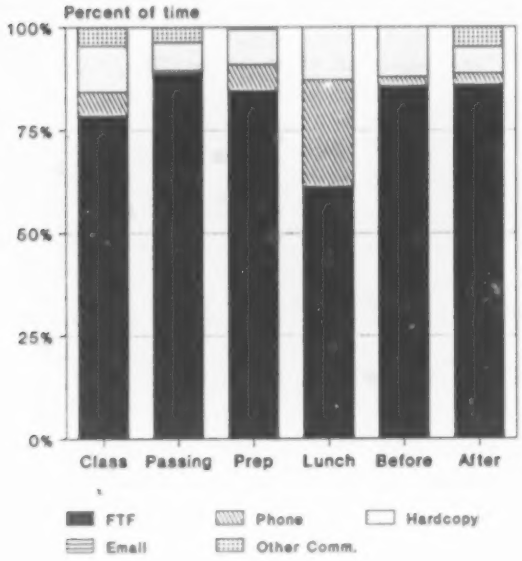
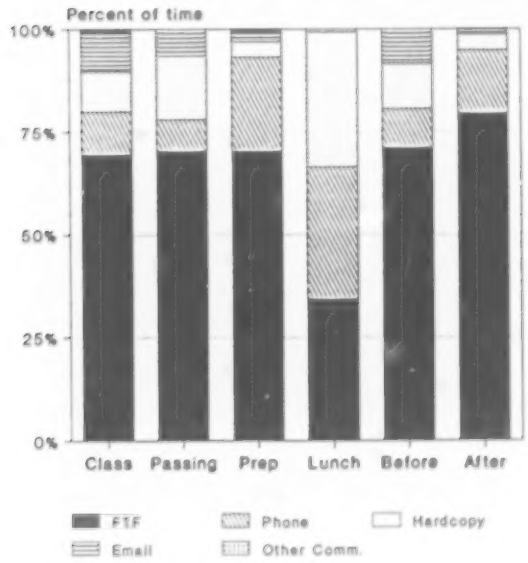


Figure 4.26
Oak Bluff Communication by Time Category



The higher percentage of incidents of communication classified as "other activity" at Mountain View is due to the presence there of an intercom system. For most time categories there is more face-to-face communication at Mountain View than at Oak Bluff. Thus, as Figures 4.25 and 4.26 show, in class, passing and before school times there are respectively 79%, 89% and 85% of face-to-face communication at Mountain View compared to only 69%, 70%, and 71% at Oak Bluff. The higher percentages of face-to-face episodes and face-to-face time at Mountain View are due in part to the structure of the neighborhood team which was assigned a common hall, prep period, students and meetings for the express purpose of promoting communication. At Oak Bluff the innovation for increasing collaboration was the electronic network, which possibly slightly decreased face-to-face communication. It is important to remember that these figures show the percentage of communication in each time category, but not the relative amounts of overall time spent in each. For example, Figures 4.25 and 4.26 show that around 75% of the communication during prep and class time is face-to-face. A teacher has far less prep time (about 45 minutes per day) than classtime (about 5 hours and 15 minutes a day), however. Although face-to-face communication consumes an equal proportion of prep and class, it is a greater amount of class time.

Channel Switching and Multitasking

Teachers often collaborate on one task in multiple events separated across time and space, often switching channels, e.g., from email to face-to-face. As in our previous research on the structure of work (Reder & Schwab 1989a, 1990), we call a series of communicative events among the same interactants on a given task a *communicative chain* and the changing of channels within a communicative chain *channel switching*. An example of a communicative chain is a teacher receiving a note from the resource room teacher suggesting that they schedule a meeting to discuss a certain student, talking, contacting the resource room teacher through email to arrange the meeting, and meeting with the resource room teacher at the end of the school day. In this example the shadowee and resource room teacher switched from one channel to another, e.g., from hardcopy to email to face-to-face while working on the same task.

Figure 4.27 plots the frequency of communicative chains as a function of chain length. As chain length increases, frequency decreases. Comparison of the two schools underscores the similar structure of work across time in both places. At Mountain View 1073 task sequences had one event and 220 had two; the number of task sequences decreases until the final figure which rises because it combines the numbers of tasks sequences for all chains with more than five events. At Oak Bluff the shape of the graph is remarkably similar; 932 task sequences had one event and 267 had two; the number of task sequences again decreases as number of events increases.

With Figure 4.28 we take this analysis one step further by showing the percentage of these communicative chains which involved a channel switch. At both schools, approximately 20% of the chains having two events involved a channel switch. As chains lengthened, the percentage having a channel switch steadily increased as well, rising to approximately 60% at a length of five events. For Mountain View, 28.70% of all chains involved a channel switch; for Oak Bluff the corresponding figure was 37.58%.

Figure 4.27
Communicative Chains

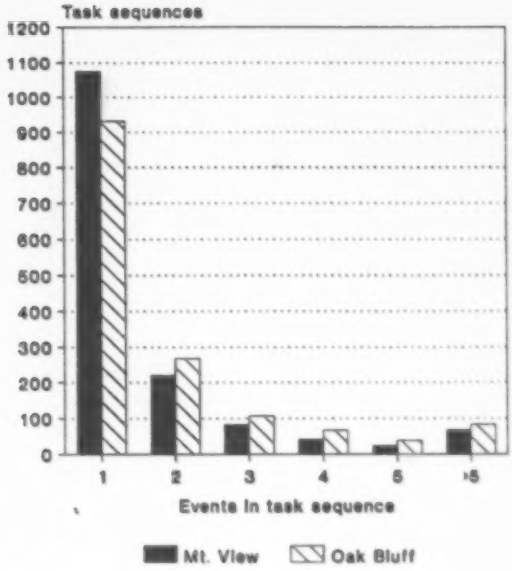


Figure 4.28
Channel Switching

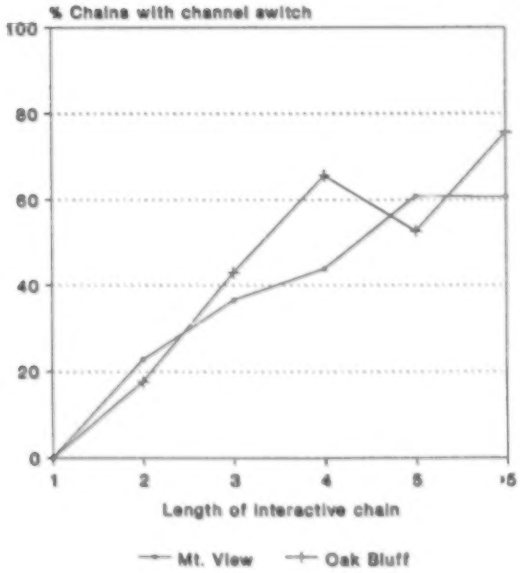
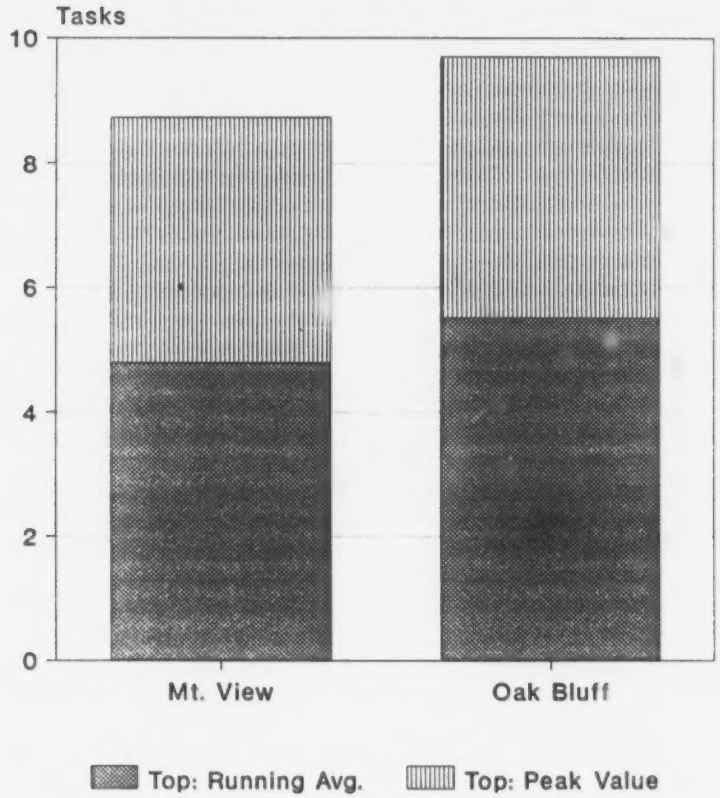


Figure 4.1 above indicated that individuals were working on a large number of non-teaching activities (in addition to the instruction, lesson planning and grading which were not the focus of this study) and in doing so collaborated with many adults. The immediately preceding paragraph shows how, for many tasks, there are chains of events in which people collaborate, often switching from one channel to another. The events of work on a task often occur across they day; they can be conceptualized as resmaining on one's stack of work to be completed. To operationalize multitasking in our shadowing data, we defined a simple way of measuring, on an ongoing basis, the size of the activity "stack" of an individual being shadowed. The operational definition used identifies a given task as being on an individual's "stack" whenever the individual (1) is not working on it at the moment; (2) has worked on it previously in the day; and (3) works on it again later the same day.

This operational definition of a task being on a stack reflects only the continuity of tasks within one day. Since many tasks are carried over from one day to the next, sometimes for many days, it underrepresents the time extent of multitasking. Nevertheless, even with these limitations it is quite high. Figure 4.29 portrays our measures of multitasking in the two schools. At Mountain View the running average task stack was 4.79 and the maximum "peak" value was 8.73. At Oak Bluff the stacks had a running average of 5.51 tasks and a peak value averaging 9.7 tasks.

Figure 4.29
Multitasking



Conclusions

A major finding of the research was that the schools were very similar in the ways teachers interacted with personnel, locations, time and communication channels to perform their work. The traditions of U.S. schooling, the social structure of the two schools, and the demanding nature of the "two jobs" at which teachers labored--instructional work and social work--determined to a large extent how teachers operated. This common structure of activity in both sites is especially remarkable in light of the potential for differences. First, the schools had different team structures, i.e., the neighborhood system in Mountain View and the committee structure which included the seventh grade faculty team in Oak Bluff. Secondly, channel availability varied across the schools; most notably, electronic mail was available at Oak Bluff and not at Mountain View. Finally, the proportion of students at risk of failure or exhibiting social or behavioral problems was much greater at Mountain View. In spite of these site differences, the overwhelming reality for all the teachers we shadowed was that they could fulfill only a part of the instructional and social work their communities and their own professional aspirations mandated. Constraints on their time and attention meant that differences in school structure, population and technology could not radically increase their effectiveness. A complex set of variables--location, social category of interactants, type of school time and communication channel--formed these constraints in both sites. The ability of teachers to switch channels as their needs and the limitations of their immediate setting required and to multi-task ("juggle" many tasks across the day) enabled them to fulfill the requirements of their jobs.

CHAPTER 5
IMPLICATIONS

This final section considers some of the implications of the preceding findings for education in general and for U S West's product development and marketing strategies for K-12 schools.

Implications for Education

Changing Teacher Roles: Job 1 and Job 2

Although many findings of the study will contribute to the research literature on communication and collaboration among teachers (and other occupational groups), the most striking and practically significant result concerns the dual roles which teachers increasingly must assume in schools--those of instructor and of social worker. Teachers, of course, have always been the direct providers of instruction to children. We term this *Job 1*. Good teachers have always gone beyond Job 1, however, to provide needed social and emotional support for their students. Although such extra-instructional activity has long been around at a relatively low level of intensity, in recent years teachers have been putting more and more energy, attention and time into doing "social work" for a growing number of children in need. Teachers increasingly find themselves needing to do social work for the increasing numbers of children who bring major social problems to school, an increasing percentage of whom do not receive the support, assistance and advocacy they need from parents or other adults. We term this *Job 2*.

Job 2 is not seen by teachers as a luxury, something to be performed only after Job 1 is done; their students urgently need the "social work" if they are to learn, to succeed in school and to develop fully. The teachers are close enough to the ground in their everyday contact with the children to know that too many do not receive the basic support and guidance they need, whether at home or from social service agencies. The teachers feel *they* must do Job 2 if the children are to thrive in school and elsewhere.

The Economy of Time and Communication

The tension between Job 1 and Job 2 for teachers' time, effort and attention is something that profoundly struck the research team during the study, and was confirmed in discussions with both the teachers who participated in the study and with educators throughout the region. The ramifications and implications of this finding are clear. Teachers, already overburdened by the pressures of trying to do Job 1 well with large class sizes and often inadequate budgets, must somehow squeeze in ample time and resources to do Job 2 as well. And to do Job 2 effectively, they often must collaborate with parents, other teachers, counselors, social service agencies and other adults as they try to meet the needs of individual children. Our study shows the time and opportunities available for such communication and collaboration to be extremely limited and precious. Some important child-oriented tasks are not accomplished simply because the few minutes required to do so are not available in an already overcrowded schedule. Other vital

tasks are not accomplished because it is too difficult for individuals outside school to collaborate with children's teachers who spend so much of their working day in the classroom.

These problems do not exist because teachers aren't trying to communicate and collaborate to help their children. In terms of the number of tasks in which they engage and the number of individuals with whom they interact to accomplish their work each day, teachers appear similar to high-level managers in other occupations or industries. (And these data do not count teachers' instructional tasks and interactions with their students, activities in which they spend a large percentage of their time.) The overlaying of a rapidly growing Job 2 onto an already crowded Job 1 agenda has created a strong need for teachers to increase their communication and collaboration with one another and with others outside of school.

Need for Better Public Understanding of Teachers' Roles and Jobs

The teachers we studied and other educators with whom we spoke about our findings perceive little public understanding, appreciation or support of teachers' Job 2 activities. Many members of the public--particulary those without children in school--are not aware of how much schools and teachers' roles have changed since they (or their children) were in school. In discussing the implications of our research, the teachers whom we studied emphatically suggested that we make sure that local newspapers be given summaries of our report. The teachers are particularly interested in having the public better understand not only how much effort is being given to Job 2, but how hard teachers work on all kinds of tasks besides delivering instruction in the classroom.

Need for Job 2 Support Systems Within Schools

Another issue is that there is little direct support for teacher collaboration for Job 2 within the schools themselves. Over the years, schools have evolved effective strategies and techniques for supporting teacher collaboration for instructional purposes, e.g., team teaching, common prep periods, targeted curriculum writing projects. But comparatively little experimentation has taken place to develop techniques (and implement technologies) for supporting communication and collaboration among teachers, social service agency staff and others who must work together to insure that each child's needs are met.

Implications for Communication Technologies in Schools

The changing context and condition of public education is forcing policy makers and educators to reevaluate and modify the ways in which schools are structured, including the ways in which schools coordinate and collaborate with communities and social service agencies. There are increasing calls for schools to assume new and expanded roles within horizontal networks of institutions and service providers. As these new roles for schools become better articulated, increasing demands for better communication and collaboration will be felt, both within schools as well as between schools and external agencies.

These changing political and institutional contexts of education are creating new needs and opportunities for products and services which vendors such as U S West's can provide. There are new niches for technologies to support both internal (i.e., within-building) and external (i.e., school-home and school-social service agency) communication. Each category will be considered briefly in turn. Finally, a suggested market strategy is presented, one which we believe will be best suited to coming changes in the K-12 educational arena.

Internal Communication Support

Our study in the middle schools indicates that classroom-based communication technologies such as electronic mail can facilitate within-building teacher communication and collaboration. Many of the benefits which email provides office workers in other settings were also observed among the classroom teachers: they can remain in close contact and share information with each other despite being relatively inaccessible for face-to-face interaction during most of the workday. And, by relying on email, teachers need not devote as much of their limited working time *outside* of the classroom to merely delivering and/or retrieving messages and shared information.

Among alternative classroom-based communication technologies, email has some clear advantages. Although it is frequently suggested that telephones be placed in classrooms to facilitate teachers' external communication, the relative privacy with which electronic mail and other text-based technologies can be utilized in an open environment such as a classroom is a clear benefit. Many student-centered conversations between teachers and other adults would be disruptive and/or violate needed confidentiality if conducted in classes. Electronic messages and files, on the other hand, can be exchanged in a much less disruptive and more confidential manner.

It is critical that, whatever technology is chosen to support internal teacher communication and collaboration, others working with the children be included and accessible as well. Resource room and Chapter 1 teachers, building administrators and specialists such as librarians, counselors and others should be part of the communication support.

External Communication Support

Teachers have increasing needs to communicate with the outside world in order to accomplish their work. Conversations, correspondence and information exchange among teachers, parents, guardians and social service agencies are seen as increasingly important for coordinating action to meet the needs of the child. Parent-teacher communication, which has traditionally been conducted during lunch, prep periods and after school hours, becomes harder to arrange as parents themselves become less accessible due to the constraints of their own work schedules. Interactions between teachers and social service agencies are greatly constrained by the relative inaccessibility of teachers for meetings or telephone conversations during working hours.

Increasing teachers' access to existing communication technologies (e.g., the telephone) and introducing newer technologies (electronic mail, voice mail) into the schools should be seen as key strategies here just as they are in other occupational

settings where time and space shifts constrain ready communication. Voice-mail and other enhanced voice services offer the potential of improving both school-home communication and collaboration as well as the collaboration and coordination of schools and social service agencies trying to meet the complex needs of society's children. Experiments using such technologies to facilitate teacher-parent communication have been conducted in Blue Grass Valley by Southwestern Bell and are currently underway in New York City by Nynex. We recommend that U S West undertake some carefully planned experiments as well to better gauge the potential impact and marketability of such products and services.

Experiments or trials using voice-based technologies to support horizontal collaboration between schools and social service agencies are also in order. The current political context, in which we hear frequent requests for better coordination and more effective collaboration among these institutions' efforts to meet children's needs, seems a particularly auspicious time to introduce such innovations. GES seems particularly well positioned to take the lead in breaking this new ground, given that its market spans both the schools and public agencies.

The Child as Beneficiary: A Potential Marketing Strategy

Although traditional market research in K-12 public education often identifies teachers, schools, and parents as the customers (acting in the interests of the child), educators tend to identify the *child* as the focal point of their own efforts. The movement to integrate and coordinate education with the provision of other social services is going to heighten the visibility of the child as the focal point of these institutional networks. Market and product strategies which similarly center around the *child* may be particularly successful in this new environment. A voice-mail system which facilitates communication among schools and public agencies (and parents, to be sure) may be particularly attractive to all of the institutional customers involved, and may offer the basis for cost-sharing arrangements that might otherwise be unrealistic. Product features and pricing structures which reflect this design might be particularly attractive, e.g., each *child* has a voice-mail box with use restricted to communication between parents, teachers, social service workers and others actively involved in meeting his or her needs. Although the given child might or might not be a direct user of the system, designing and marketing the system as one which facilitates child-centered service provision could go a long way towards justifying and appropriately distributing the costs of the technology.

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APPENDIX A -- SHADOW OBSERVATION PROTOCOL

"Time Category": Marks the kind of school time designated in the school schedule. A "c" in this column indicates class time when the teacher is assigned to teach a group of students. A "b" indicates time before school; an "a" indicates time after school; a "pp" indicates a preparation period when the teacher has no class (while some teachers do have classes); a "ps" indicates the period for passing from one class to the next; and an "l" indicates lunchtime.

"Start": marks the beginning of an observed event.

"Continued": If marked by a "C," this column indicates that the activity is a continuation of an earlier activity which was interrupted by the subject or someone or something outside the subject's control. A blank space in this column indicates that the episode is not a continuation after an interruption.

"Location": indicates the room or area where the activity took place. The number assigned by the school will be used; if there is no assigned number, the researchers will assign one for coding purposes. The default is the subject's classroom and is indicated by a blank field.

"Clustered Events": A "*" in the columns of two or more temporally adjacent events indicates that the two events are integrally related to each other and that the subject repeats them in succession one or more times within a two minute period (e.g., reading a name from a roll sheet and writing it on a form, then reading and writing the next name, and so on). An "s" in the cluster column of the event following the cluster indicates that this event is the same event (not merely the same event type) as one of the events in the cluster (e.g., after finishing the repetition of alternately reading a document and writing on it, reading the entire document for more than two minutes) or the immediately preceding event (e.g., resuming a face-to-face meeting of which the completed succession of reading and writing was a part). A "d" in the cluster column indicates that the event following the cluster is not the same event as one of the events in the cluster or the event immediately preceding the cluster.

"New Episode"?: A check ("√") in the "New Episode?" column indicates that the event marks the beginning of an objective toward which the participants direct their activities which is different from the objective entailed in the immediately preceding event (e.g., after ceasing to write letters to parents at her desk, a teacher attends a committee meeting on students at-risk).

"Event Type": For the purposes of this study, a communicative event is defined as an observably distinct interaction involving the subject and another participant(s) using a particular communication channel (e.g., a teacher telling the secretary that he feels ill and needs a substitute). The coding options indicating the type of communication event are:

"f": exchanging words with another person.

"dt": creating a ditto copy (ies) of a document.

"pt" creating a print-out of an electronic document.

"x": photocopying a document.

"tc": creating a temporary display. Events of this type would include sketches on whiteboards, chalkboards or other types of media resulting in "documents" which are not permanent.

"to": observing a temporary display.

"pdc": creating a permanent display.

"pdo": observing a permanent display.

"p(r)": phoning (or receiving a phone call).

"pm(r)": leaving (or receiving) a phone message.

"pb(r)": returning a phone call in response to the receipt of a phone message (or receiving a call in response to a message left).

"it(r)": sending (or receiving) a message over the intercom.

"er": reading an electronic message.

"ero": reading and observing an electronic message.

"eo": observing an electronic message.

"ec"; creating an electronic message.

"do": observing a hard copy document.

"dc": creating a hard copy document.

"dh": sending a hard copy document by hand.

"du": sending a hard copy document through the U.S. mail.

"ds": sending a hard copy document through the school mail system.

"dhr": receiving a document sent by hand.

"dur": receiving a document sent via U.S. mail.

"dsr": receiving a document sent via school mail.

"dhro": receiving and observing a document sent by hand.

"duro": receiving and observing a document sent via U.S. mail.

"dsro": receiving and observing a document sent via school mail.

"(f)": qualifying a communicative event indicates that the subject attempted to communicate but failed to do so (e.g., dialing a phone number and receiving no answer).

"(s)": qualifying a communicative event indicates that the event was scheduled in advanced (elg., a faculty meeting).

"w": The focus of the study is communication among adults providing education to students. When the teacher observed interacts with students and no other adult is present and when the teacher works planning curriculum or other material for students, the behavior is coded "w" for work.

"o": indicates activities which are primarily personal or recreational and not work (e.g., taking a break for coffee or a chat about a family matter).

"Unacknowledged": A "U" in the column after "event type" indicates that a communication sent to the subject which could have interrupted the subject's ongoing activity was unacknowledged by the subject. A communication in the visual channel is coded as unacknowledged when the subject exhibits no awareness of it (e.g., has his back turned to a door under which a notice is slipped). A communication in the auditory channel is coded as unacknowledged when the subject reveals no sign of having heard (e.g., does not stop talking while a message comes over the intercom).

"Task Number": Identifies a task undertaken during the work day of the subject. Tasks are defined as units of accomplishment or purposeful activity meaningful to the subject. A task can be made up of a single or multiple events, and a person can complete a task in one uninterrupted period (e.g., answering a wrong number) or by working on it off and on throughout the day (e.g., writing a proposal during several discontinuous sessions).Tasks are identified and numbered sequentially throughout the day. When a task reappears later in the day, its original task number is coded to facilitate tracking the time spent on it and identifying surrounding activities.

"Participants": Identifies other persons involved in the communicative event. A person entering or leaving the interaction is indicated by a "+" or "-" followed by that person's name; The names of all adults (school personnel, parents, and others) communicating with the subject are coded in this manner; communication with students is not coded unless the child is mediating communication between the subject and another adult. Where the interaction is initiated by someone other than the subject of the session, that person's name is circled unless the event type already identifies the initiator (e.g., "er" indicates email received by the subject).

"Mediated?": Indicates that the communication from the participant was sent to another individual who then relayed it to the subject without making any changes. If that individual's name is known it is written in the "Mediation?" column; if not, a "√" is marked. (For example, if a secretary took a message and sent the information to a teacher over the intercom, "sec", and her name, if known, would be marked in the column). A common example of mediated communication is the hall pass: the subject sends it to faculty (participants), informing them that the student has permission to be out of class, and the student (mediator) sends the message. "Student" in this column would indicate the student's role. Mediators include secretaries, administrators, aides, teachers, and others.

"Prior Event": This column is filled out for written events only. If the teacher previously wrote on the current message, the most recent time he/she did so is recorded here.

"Comments/Notes": Notes concerning the interaction charted on that particular row to add precision and context.

APPENDIX B--NUMERICAL TABLES

Table 4.1 Teachers' Activities (Percent of Time)

	Mt. View		*Oak Bluff*	
	Minutes	*%*	*Minutes*	*%*
Teaching	9649	68.53 *	8745	61.03
Non-Teaching	4431	31.47	5583	38.97

Table 4.2 Average Tasks Per Day

School	*Mean Tasks Per Day*
Mt. View	37.00
Oak Bluff	43.57

Table 4.3 Communication by Location (Episodes)

	Mt. View		*Oak Bluff*	
	N	*%*	*N*	*%*
Own Classroom	615	39.88	917	46.06
Team Classroom	89	5.77	97	4.87
Other Classroom	23	1.49	104	5.22
Hall	237	15.37	178	8.94
Office	444	28.79	465	23.36
Other	134	8.69	230	11.55

Table 4.4 Communication Time by Location (Percent of Time)

	Mt. View		*Oak Bluff*	
	Minutes	*%*	*Minutes*	*%*
Own Classroom	1030	39.02	1102	32.85
Team Classroom	178	6.74	214	6.38
Other Classroom	155	5.87	390	11.62
Hall	337	12.77	223	6.65
Office	419	15.87	779	23.22
Other	521	19.73	647	19.28

Table 4.5 Distinct Interactants Per Day

School	*Mean Interactants Per Day*
Mt. View	26.53
Oak Bluff	29.10

*Totals not equal to 100% reflect the rounding of numbers to the nearest one hundredth.

Table 4.6 Communication by Social Category (Episodes)

	Mt. View		*Oak Bluff*	
	N	*%*	*N*	*%*
Core Team	507	20.25	698	20.64
Other School Staff	1664	65.65	2230	65.96
Outsiders	353	14.10	453	13.40

Table 4.7 Mt. View Channel Use by Social Category (Episodes)

	Core Team		*Other Staff*		*Outsiders*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	462	81.48	1144	62.89	108	29.83
Phone	0	0.00	6	0.33	44	12.15
Hardcopy	88	15.52	528	29.03	202	55.80
Email	0	0.00	0	0.00	0	0.00
Other Communication	17	3.00	141	7.75	8	2.21

Table 4.8 Oak Bluff Channel Use by Social Category (Episodes)

	Core Team		*Other Staff*		*Outsiders*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	405	57.04	1387	60.59	103	22.54
Phone	0	0.00	20	0.87	143	31.29
Hardcopy	33	4.65	309	13.50	195	42.67
Email	272	38.31	569	24.86	11	2.41
Other Communication	0	0.00	4	0.17	5	1.09

Table 4.9 Mt. View Class Time: Social Categories (Episodes)

	Core Team		*Other Staff*		*Outsiders*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	38	82.61	251	56.66	22	27.50
Phone	0	0.00	6	1.35	12	15.00
Hardcopy	3	6.52	127	28.67	43	53.75
Email	0	0.00	0	0.00	0	0.00
Other Communication	5	10.87	59	13.32	3	3.75

Table 4.10 Oak Bluff Class Time: Social Categories (Episodes)

	Core Team		*Other Staff*		*Outsiders*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	81	37.33	458	53.26	25	23.36
Phone	0	0.00	7	0.81	33	30.84
Hardcopy	15	6.91	102	11.86	45	42.06
Email	121	55.76	292	33.95	3	2.80
Other Communication	0	0.00	1	0.12	1	0.93

Table 4.11 Mt. View Locations: Social Categories (Episodes)

	Core Team		*Other Staff*		*Outsiders*	
	N	*%*	*N*	*%*	*N*	*%*
Own Classroom	130	28.14	634	40.93	155	45.45
Team	117	25.32	82	5.29	20	5.87
Other Classroom	1	0.22	45	2.71	2	0.59
Hall	112	24.24	147	9.49	22	6.45
Office	30	6.49	345	22.27	135	39.59
Other	72	15.58	299	19.30	7	2.05

Table 4.12 Oak Bluff Locations: Social Categories (Episodes)

	Core Team		*Other Staff*		*Outsiders*	
	N	*%*	*N*	*%*	*N*	*%*
Own Classroom	341	50.59	1161	54.15	163	37.30
Team	84	12.46	49	2.29	10	2.29
Other Classroom	17	2.52	121	5.64	31	7.09
Hall	58	8.61	128	5.97	10	2.29
Office	96	14.24	333	15.53	177	40.50
Other	78	11.57	352	16.42	46	10.53

Table 4.13 Time Categories (Episodes)

	Mt. View		*Oak Bluff*	
Time Categories	*N*	*%*	*N*	*%*
Class	6797	50.75	7022	54.40
Passing	1138	8.50	1098	8.51
Prep	1148	8.57	1016	7.87
Lunch	1060	7.91	948	7.34
Before	1582	11.81	843	6.53
After	1668	12.45	1981	15.35

Table 4.14 Activities: Episode Distribution

	Mt. View		*Oak Bluff*	
	N	*%*	*N*	*%*
Face-toFace	918	26.75	1129	25.81
Phone	36	1.05	140	3.20
Hardcopy	452	13.17	370	8.46
Email	0	0.00	304	6.95
Other Communication	82	2.39	7	0.16
Other Activities	1945	56.65	2425	55.42

Table 4.15 Activities: Time Distribution

	Mt. View		*Oak Bluff*	
	Minutes	*%*	*Minutes*	*%*
Face-toFace	1841	13.64	2142	16.31
Phone	107	0.79	421	3.21
Hardcopy	210	1.56	266	2.03
Email	0	0.00	149	1.13
Other Communication	62	0.46	8	0.06
Other Activities	11280	83.55	10149	77.26

Table 4.16 Activities: Episode Duration

	Mt. View	*Oak Bluff*
	Minutes	*Minutes*
Face-toFace	2.00	1.90
Phone	3.00	3.00
Hardcopy	0.50	0.70
Email	0.00	0.50
Other Communication	0.80	1.10
Other Activities	5.80	4.19

Table 4.17 Communication: Episode Distribution

	Mt. View		*Oak Bluff*	
	N	*%*	*N*	*%*
Face-toFace	918	61.69	1129	57.90
Phone	36	2.42	140	7.18
Hardcopy	452	30.38	370	18.97
Email	0	0.00	304	15.59
Other Communication	82	5.51	7	0.36

Table 4.18 Communication: Time Distribution

	Mt. View		*Oak Bluff*	
	Minutes	*%*	*Minutes*	*%*
Face-toFace	1841	82.93	2142	71.73
Phone	107	4.82	421	14.10
Hardcopy	210	9.46	266	8.91
Email	0	0.00	149	4.99
Other Communication	62	2.79	8	0.27

Table 4.19 Mt. View Activities by Time Category (Episodes)

	Class		*Passing*		*Prep.*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	206	17.37	103	25.88	137	40.41
Phone	12	1.01	1	0.25	4	1.18
Hardcopy	69	5.82	17	4.27	62	18.29
Email	0	0.00	0	0.00	0	0.00
Other Communication	48	4.05	8	2.06	4	1.18
Other Activities	851	71.75	269	67.59	132	38.94

	Lunch		*Before*		*After*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	19	15.70	247	29.20	201	38.21
Phone	3	2.48	6	0.71	10	1.90
Hardcopy	28	23.14	206	24.35	69	13.12
Email	0	0.00	0	0.00	0	0.00
Other Communication	4	3.31	6	0.71	12	2.28
Other Activities	67	55.37	381	45.03	234	44.49

Table 4.20 Oak Bluff Activities by Time Category (Episodes)

	Class		*Passing*		*Prep.*	
	N	%	*N*	%	*N*	%
Face-toFace	381	18.22	156	28.84	135	33.50
Phone	33	1.58	15	2.77	25	6.20
Hardcopy	89	4.26	67	12.38	19	4.71
Email	166	7.94	35	6.47	25	6.20
Other Communication	2	0.10	0	0.00	2	0.50
Other Activities	1420	67.91	268	49.54	197	48.88

	Lunch		*Before*		*After*	
	N	%	*N*	%	*N*	%
Face-toFace	35	22.44	107	24.77	306	42.15
Phone	13	8.33	8	1.85	46	6.34
Hardcopy	25	16.03	106	24.54	63	8.68
Email	4	2.56	46	10.65	28	3.86
Other Communication	0	0.00	0	0.00	3	0.41
Other Activities	79	50.64	165	38.19	280	38.56

Table 4.21 Mt. View Activities by Time Category (Percent of Time)

	Class		*Passing*		*Prep.*	
	Minutes	%	*Minutes*	%	*Minutes*	%
Face-toFace	378	5.56	144	12.65	287	25.00
Phone	27	0.40	1	0.09	21	1.83
Hardcopy	54	0.79	11	0.97	29	2.53
Email	0	0.00	0	0.00	0	0.00
Other Communication	22	0.32	6	0.53	2	0.17
Other Activities	6316	92.93	976	85.76	809	70.47

	Lunch		*Before*		*After*	
	Minutes	%	*Minutes*	%	*Minutes*	%
Face-toFace	76	7.17	428	27.05	509	30.52
Phone	32	3.02	10	0.63	16	0.96
Hardcopy	16	1.51	61	3.86	38	2.28
Email	0	0.00	0	0.00	0	0.00
Other Communication	0	0.00	3	0.19	29	1.74
Other Activities	936	88.30	1080	68.27	1076	64.50

Table 4.22 Oak Bluff Activities by Time Category (Percent of Time)

	Class		*Passing*		*Prep.*	
	Minutes	*%*	*Minutes*	*%*	*Minutes*	*%*
Face-toFace	564	8.03	204	18.58	277	27.26
Phone	84	1.20	22	2.00	90	8.86
Hardcopy	80	1.14	45	4.10	15	1.48
Email	80	1.14	19	1.73	10	0.98
Other Communication	4	0.06	0	0.00	2	0.20
Other Activities	6210	88.43	808	73.59	622	61.22

	Lunch		*Before*		*After*	
	Minutes	*%*	*Minutes*	*%*	*Minutes*	*%*
Face-toFace	55	5.80	237	28.11	732	36.95
Phone	52	5.49	31	3.68	142	7.17
Hardcopy	53	5.59	37	4.39	35	1.77
Email	1	0.11	28	3.32	11	0.56
Other Communication	0	0.00	0	0.00	2	0.10
Other Activities	787	83.01	510	60.50	1059	53.45

Table 4.23 Mt. View Communication by Time Category (Episodes)

	Percent of Episodes					
	Class		*Passing*		*Prep.*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	206	61.49	103	79.84	137	66.18
Phone	12	3.58	1	0.78	4	1.93
Hardcopy	69	20.60	17	13.18	62	29.95
Email	0	0.00	0	0.00	0	0.00
Other Communication	48	14.33	8	6.20	4	1.93

	Lunch		*Before*		*After*	
	N	*%*	*N*	*%*	*N*	*%*
Face-toFace	19	35.19	247	53.12	201	68.84
Phone	3	5.56	6	1.29	10	3.42
Hardcopy	28	51.85	206	44.30	69	23.63
Email	0	0.00	0	0.00	0	0.00
Other Communication	4	7.41	6	1.29	12	4.11

APPENDIX B--NUMERICAL TABLES

Table 4.24 Oak Bluff Communication by Time Category (Episodes)

	Percent of Episodes					
	Class		*Passing*		*Prep.*	
	N	%	*N*	%	*N*	%
Face-toFace	381	56.78	156	57.14	135	65.53
Phone	33	4.92	15	5.49	25	12.14
Hardcopy	89	13.26	67	24.54	19	9.22
Email	166	24.74	35	12.82	25	12.14
Other Communication	2	0.30	0	0.00	2	0.97
	Lunch		*Before*		*After*	
	N	%	*N*	%	*N*	%
Face-toFace	35	45.46	107	40.07	306	68.61
Phone	13	16.88	8	3.00	46	10.31
Hardcopy	25	32.47	106	39.70	63	14.13
Email	4	5.19	46	17.23	28	6.28
Other Communication	0	0.00	0	0.00	3	0.67

Table 4.25 Mt. View Communication by Time Category (Percent of Time)

	Class		*Passing*		*Prep.*	
	Minutes	%	*Minutes*	%	*Minutes*	%
Face-toFace	378	78.59	144	88.89	287	84.66
Phone	27	5.61	1	0.62	21	6.19
Hardcopy	54	11.23	11	6.79	29	8.55
Email	0	0.00	0	0.00	0	0.00
Other Communication	22	4.57	6	3.70	2	0.59
	Lunch		*Before*		*After*	
	Minutes	%	*Minutes*	%	*Minutes*	%
Face-toFace	76	61.29	428	85.26	509	85.98
Phone	32	25.81	10	1.99	16	2.70
Hardcopy	16	12.90	61	12.15	38	6.42
Email	0	0.00	0	0.00	0	0.00
Other Communication	0	0.00	3	0.60	29	4.90

Table 4.26 Oak Bluff Communication by Time Category (Percent of Time)

	Class		*Passing*		*Prep.*	
	Minutes	*%*	*Minutes*	*%*	*Minutes*	*%*
Face-toFace	564	69.46	204	70.34	277	70.30
Phone	84	10.34	22	7.59	90	22.84
Hardcopy	80	9.85	45	15.52	15	3.81
Email	80	9.85	19	6.55	10	2.54
Other Communication	4	0.49	0	0.00	2	0.51

	Lunch		*Before*		*After*	
	Minutes	*%*	*Minutes*	*%*	*Minutes*	*%*
Face-toFace	55	34.16	237	71.17	732	79.39
Phone	52	32.30	31	9.31	142	15.40
Hardcopy	53	32.92	37	11.11	35	3.80
Email	1	0.62	28	8.41	11	1.19
Other Communication	0	0.00	0	0.00	2	0.22

Table 4.27 Communicative Chains

	Tasks Sequences	
Chain Length	*Mt. View Frequency*	*Oak Bluff Frequency*
1	1073	932
2	220	267
3	82	107
4	41	67
5	23	38
>5	66	82

Table 4.28 Channel Switching

	Tasks Sequences	
Chain Length	*Mt. View % Chains With Switch*	*Oak Bluff % Chains With Switch*
1	0.00	0.00
2	22.73	17.60
3	36.59	42.99
4	43.90	65.67
5	60.87	52.63
>5	60.61	75.61

Table 4.29 Multitasking

	Stack Size	
School	*Running Average*	*Peak Value*
Mt. View	4.79	8.73
Oak Bluff	5.51	9.70